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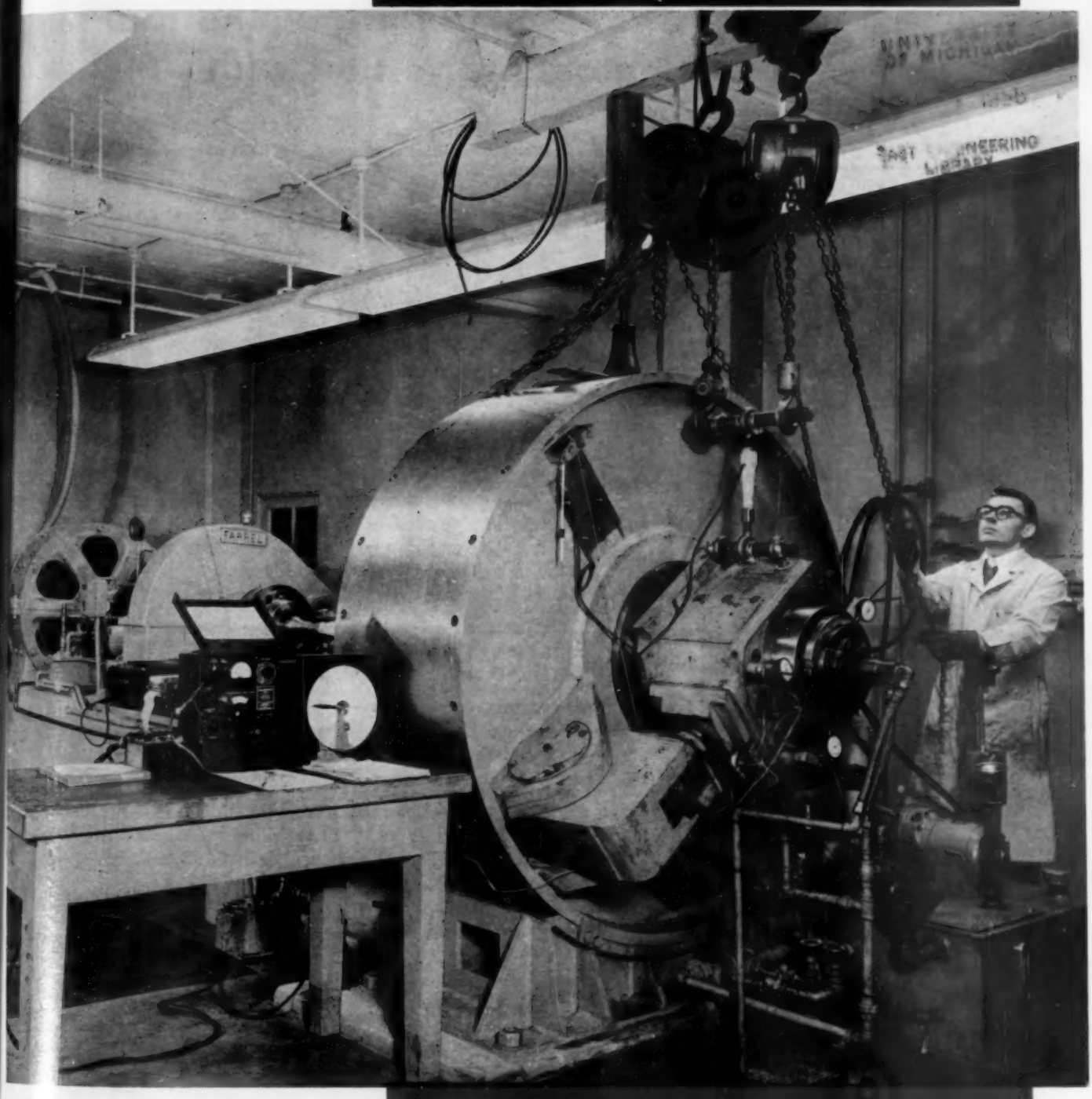
NOVEMBER 1956

PLASTICS TECHNOLOGY

THE MAGAZINE OF APPLIED ENGINEERING



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PLASTICS TECHNOLOGY

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"Quote . . . Unquote"

Chemical Industry Obligations

"We have seen over the past five years a significant increase in the use of products of chemistry in shelter—chemically treated wood, woven glass fibers, new paints, synthetic fibers, and, of course, plastics. Plastics everywhere—from panels and ducts to flooring and sink tops.

"These new uses present a new responsibility. And in this area, industry has already taken a positive step. Today, we have under way a project in cooperation with the Society of the Plastics Industry which will, we hope, have a revolutionary effect on building codes as far as the use of plastic products is concerned.

"We can safely predict a material increase over the four billion pounds of plastic materials slated to be produced this year. Again, we come face to face with responsibility. While plastic materials have many values in building construction, some may offer a flammability hazard. It is up to us to make sure in every way possible that our recommendations regarding the use of plastics in building do not in any way sacrifice safety for sales. And we will make sure of that."

Gen. J. E. Hull, President
Manufacturing Chemists' Association, Inc.
Washington, D. C.

• • •

Research and Progress

"Pioneering in the laboratory entails the same kind of risks, the same kind of disappointments, the same kind of frustrations as those faced by Daniel Boone and his party at the Cumberland Gap. It is slow and often fruitless plodding and, like the frontiersman, it seems that it must allow for failures and mistakes as well as for triumphs and discoveries.

"Our destiny lies ahead. Which way the road will lead or what precisely lies over the hill we cannot say. We are sure that the way lies forward, that great progress will be made, and that the shape of our accomplishments, when they are reckoned up a century hence, would astonish us if we could live to see them.

"Our own industry will surely be a leader in this forward movement. We will, I know, contribute enormously to the general advance, both in what we demonstrate as true and what we demonstrate as false. It has been the eternal characteristic of research to humiliate and embarrass those who were unwary enough to describe what lay ahead.

"If we are wise, we will set our sights high. Most of our country's progress has come through a spirit of boundless confidence and optimism."

C. H. Greenewalt, President
E. I. du Pont de Nemours & Co.
Wilmington, Del.

Letters to the Editor

Like Guest Editorial by Nalle

Dear Sir:

We want to thank you for publishing Mr. George S. Nalle's guest editorial ("Are You Financing Your Competitor?") in the October issue. This is a problem which has plagued our industry for many years, and Mr. Nalle's proposal may be a means of cleaning it up.

O. C. Wilson, President,
Wilson Plastics, Inc.
Sandusky, Ohio

Dear Sir:

We are very pleased with two particular features of George S. Nalle's guest editorial:

(1) The fact that PLASTICS TECHNOLOGY would print this article which is definitely critical of the raw material manufacturers. In view of the fact that the same chemical corporations supply the bulk of the wherewithal to finance your magazine, it takes editorial intestinal fortitude to print an item of this nature.

(2) We wholeheartedly endorse Mr. Nalle's well taken point that the large chemical concerns should use their extensive advertising facilities to educate the public about plastics, particularly on price increases. I am sure that the molders in the U. S. A., as well as we here in Canada, all have the same feeling of being caught in the middle all too many times when raw material increases in price. In a great many instances, it is absolutely impossible to pass all these increases on to the ultimate customer. Where retail price is set, a raw material price increase has the effect of reducing the molder's and end manufacturer's net profit at least for some time.

A. J. Fuller, Manager,
Rainbow Plastic, Ltd.
Buckingham, Que., Canada

• • •

Sources for Display Materials

Dear Sir:

We represent a client who has commissioned us to acquire scientific marvels and wonders covering a broad field of general science of interest to the la man that will be incorporated into permanent Hall of Science. The fi Hall will be erected in Florida, the se ond in California, and the third ne New York City. The initial budget f display, exclusive of building a grounds, is set at $200,000, and w cover all timely subjects.

The object of this letter is to solic your aid in telling us where we c secure three types of plastics for accom plishing effects of the following nature (1) A few ounces of a liquid to b poured into a conventional test tub perhaps an activator added, and aft just a few seconds of agitation or hea have a tremendous change take plac from the open end of the test tub whereby the contents are so aerate and the expansion so great as to be high ly impressive.
(2) Liquids are combined in a test tub and, through the application of heat o agitation for a few seconds, solidify o congeal into a rubber-like mass tha could be bounced if thrown on the floor
(3) A liquid plastic that when poured from a pitcher into a receptacle that i two or three feet below the pouring spout, produces "antics" in the form of bending or twisting of the poured column that is vastly different from that of water and like liquids.

These three plastics effects are to be demonstrated and the used materials then discarded.

We are anxious to obtain sources of supply from whom we can arrange to procure such quantities of materials as would be required for a lengthy period of display time.

Francis Cowgill, Managing Director,
Universal Invention Sales
Marion, Ohio

(What suggestions can our readers make to help Mr. Cowgill?—Editor)

• • •

Source for Conveyor Equipment

Dear Sir:

We are interested in learning of a source for conveyor equipment to be used for the visual inspection of small parts, about the size of buttons or bottle caps.

Wilfred Lynch
Moxness Products, Inc.
Racine, Wisconsin

(Can our readers offer any suggestions? All replies will be forwarded to the inquirer.—Editor)

• • •

...ants Small Heat-Sealing Unit

Dear Sir:

We are trying to locate for one of our clients the name of the manufacturer of a small plastic heat-sealing device which encases drivers' licenses and business cards in a sealed plastic envelope. The equipment is also used to encase reduced reproductions of school diplomas and other similar certificates.

Can you help us locate this manufacturer? Your assistance would indeed be appreciated.

S. Chas. Walls, Jr.
Suncoast Consultants
St. Petersburg, Fla.

(A list of suggested suppliers of the unit in question has been sent to Mr. Walls. —Editor)

• • •

Waterproof Coating for Concrete

Dear Sir:

We are seeking a coating which can be sprayed or painted on concrete to form a waterproof surface. Cure of such a coating must be either chemically or air dried, and the cured coating must be able to take up slight amounts of movement in the concrete.

(Identity Withheld)

(What can our readers suggest for transmittal to the inquirer?—Editor)

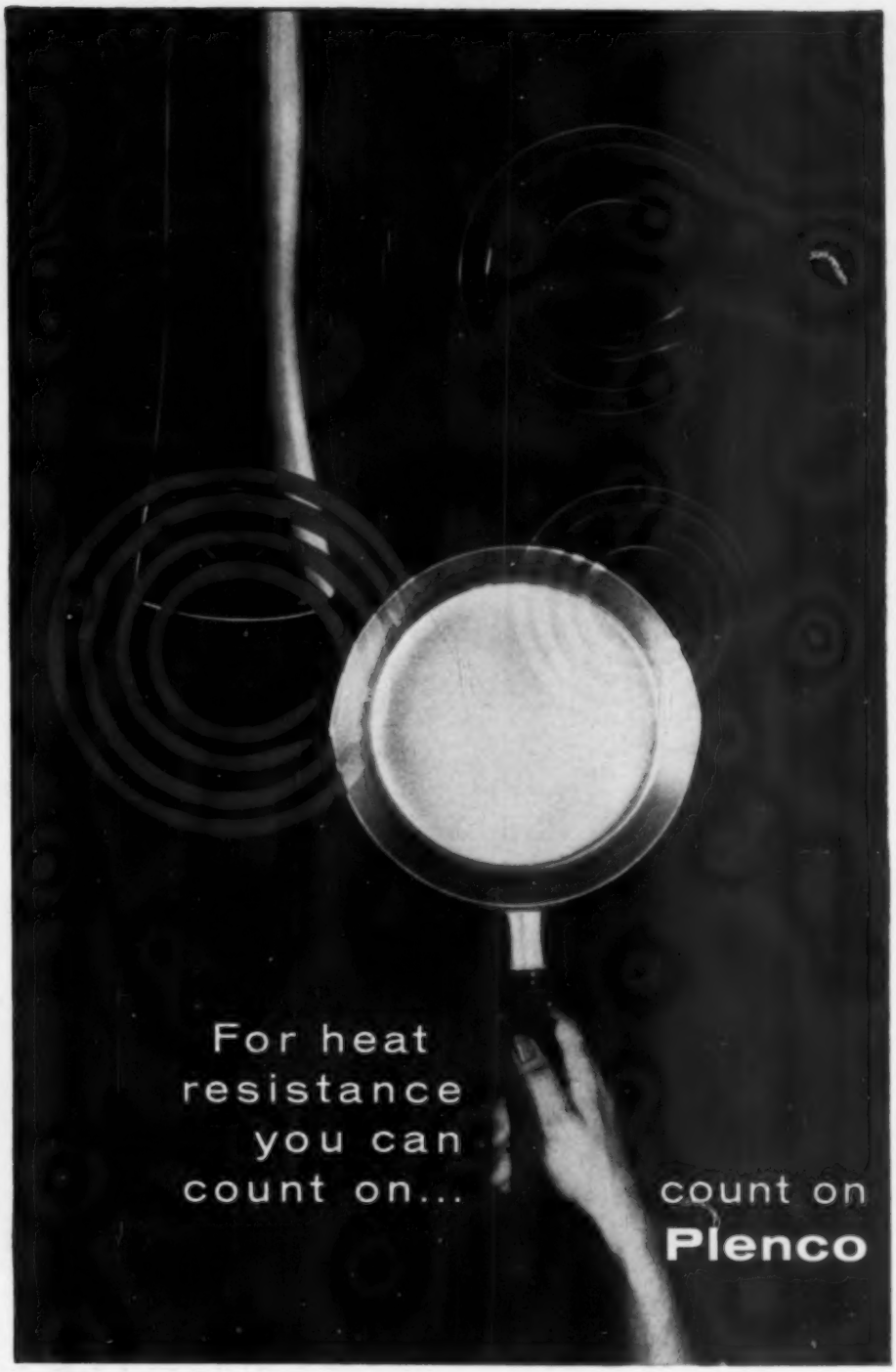
• • •

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation, and address.

A letter will not be printed if publication is not desired by the sender.

Letters requesting information on technical or engineering problems will be printed to elicit replies by the readers, either directly or through these columns. Upon request the identities of such "problem" letters will not be divulged.

—The Editor



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NEWS in BRIEF

Road to plastics maturity is bringing the industry to a general awareness of its responsibilities to the consumers of its products, says Charles Lichtenberg, of Monsanto (see guest editorial, page 736). He urges the emphasizing of six points: (1) Unceasing vigilance to guard against misapplications; (2) Establishment of additional minimum standards of manufacture and performance; (3) Wider adoption of informative labeling of products; (4) A broad program of customer and consumer education; (5) Avoiding over-promotion of products by misleading advertising and publicity; and (6) Resisting the urge to imitate non-plastic materials in applications.

Many company developments are in the news this month. Escambia Bay Chemical Corp. changed its corporate name to Escambia Chemical Corp. Cellofilm Industries was purchased by a group of private citizens. General Tire acquired A. M. Byers Co. Thermaflow Corp. was purchased by Atlas Powder. Topp Industries is buying Heli-Coil Corp. Dickmont Plastics, a new molding company, was established in Stamford, Conn. A new subsidiary, Quelcor of Cincinnati, was formed by Quelcor, Inc. to work in the field of corrosion-resistant plastisols.

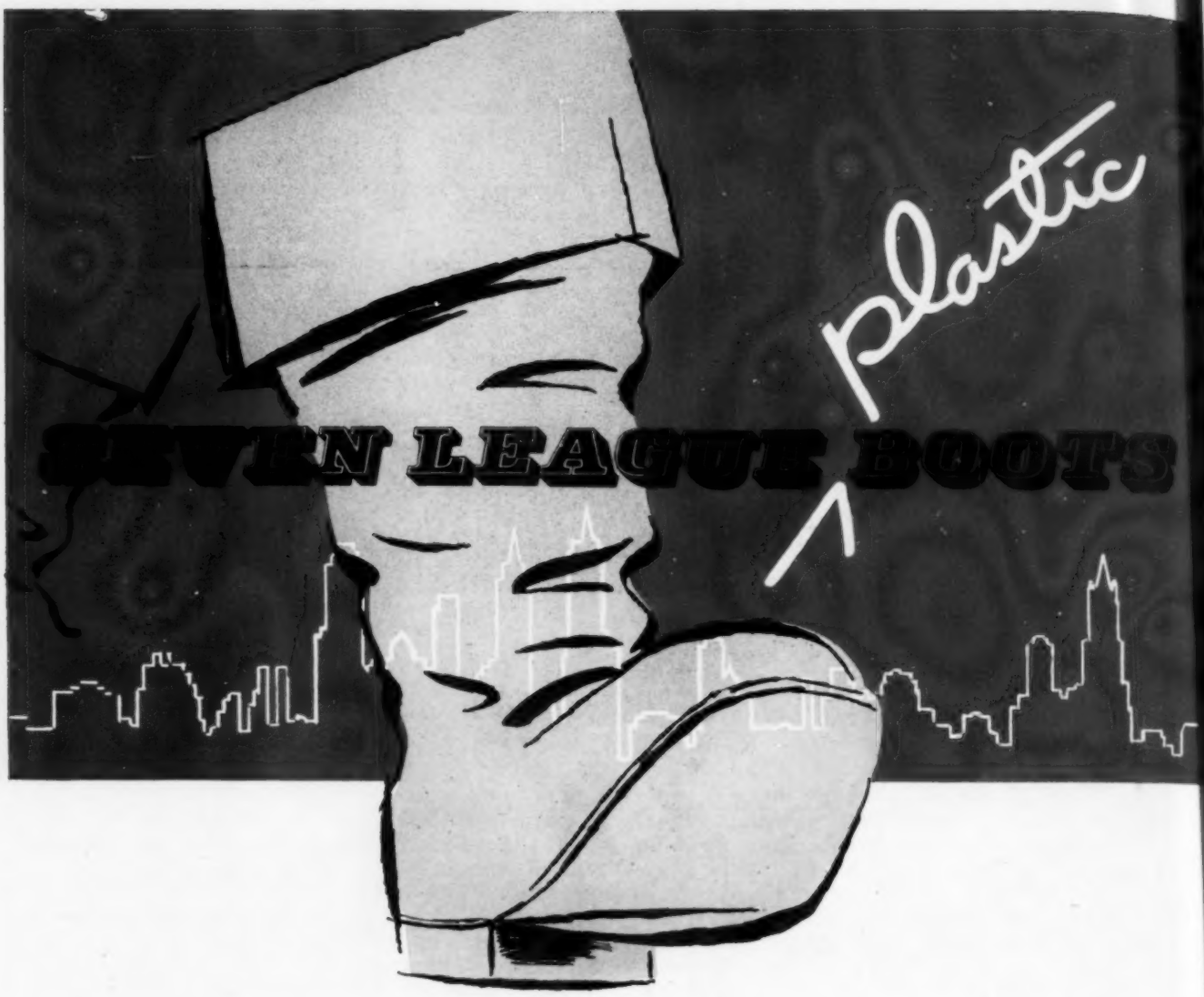
Organizational changes in plastics companies include the establishment of a new division for polyurethane foam systems by Dayton Rubber; the creation by Du Pont of an Elastomer Chemicals Department; and the formation by General Shoe of a new division, General Adhesives Co.

Flood of company expansions in plastics shows no signs of abating. Borden plans a West Coast pentaerythritol plant with annual productive capacity of 10-million pounds. Budd is building a $1,750,000 addition to the Bridgeport, Conn., plant of its Continental-Diamond Fibre Division. Celanese is constructing a new polyol unit at its Bishop, Tex., plant. Plans to enter the acetylene-producing field were disclosed by Diamond Alkali. Two announcements were made by Du Pont: the elastomers lab at Chestnut Run, Del., will be expanded; and the film department's plants at Clinton, Ia., and Circleville, O., will be enlarged. Goodrich Chemical opened its new headquarters building in Cleveland, O., and will build an acrylic polymer plant in Calvert City, Ky. MCI Plastics' new injection molding plant near Lakewood, N. J., is now in full production. Molded Fiber Glass Boat is building a new plant in Union City, Pa. National Petro-Chemicals expects full-scale production of medium-density polyethylenes by year-end, and is expanding facilities at its Tuscola, Ill., plant. Ohio-Apex opened a new office and warehouse in Los Angeles, Calif. The Glenside, Pa., plant of Penn-Plastics is being expanded. Rezolin is erecting a new office building in Santa Monica, Calif. A new research-development lab is being built by Richardson adjacent to its offices in Melrose Park, Ill., Textron is opening a new polyethlene plant in Jacksonville, Ill., for its Kordite division. U. S. Rubber's research center near Preakness, N. J., is nearing completion. A new plant for making plastic items for the appliance and automotive fields was opened by Wabash Rubber & Plastics in Seymour, Ind.

New Materials of special interest (see pages 760-1): mixed phthalate ester plasticizer for vinyls; higher-density polyethylene molding material; woven rovings of Type E glass for plastics reinforcement; diethyl silicone oil release agent; destaticizing compound for plastic moldings; flexible epoxy resin; and a heat-resistant acrylic resin.

New Equipment worthy of mention (see pages 762-3): automatic transfer molding press; electrically-conductive rubber heating blankets; void detector and recorder; and machines for making two-component urethane foams.

New Products to be noted (see pages 764-5): stackable polyethylene drums; Teflon-base anti-static coating for industrial equipment; extruded linear polyethylene sheets; molded acrylic fixture for fluorescent lights; molded phenolic frames for silk screens; glass-reinforced polyester plastic roof for jeeps; and paper-base phenolic laminate sheets.



In giant strides the plastics industry moves forward . . . developing and producing a vast array of products to meet ever-increasing industrial and consumer requirements.

Escambia Chemical Corporation took its first step in true "seven-league" style . . . moving in a matter of months from paper plan, through plant construction, to production of its first family of products—ammonia, nitric acid, ammonium nitrate and nitrogen fertilizer materials.

Construction is rapidly nearing completion on Escambia's 30 million pound Polyvinyl Chloride Resins plant at its site near Pensacola, Florida.

Production will start shortly on the second family of products beginning with a general purpose, easy processing Polyvinyl Chloride Resin for use in the calendering, extrusion and molding industries. Following this, the plant will produce a molecular weight range of straight PVC Resins including types for electrical and rigid applications.

As a dependable new source of raw materials, Escambia joins the forward march of a fast moving, dynamic industry.

ESCAMBIA CHEMICAL
CORPORATION

261 MADISON AVENUE • NEW YORK 16, N. Y.

PLASTICS TECHNOLOGY

NOVEMBER, 1956

EDITORIAL: Education of the Plastics Processor

Everyone in the plastics industry is an enthusiastic supporter of the industry's campaign to educate the public about plastics. This is designed to erase the stigma carried by the word "plastics" in the consumer's mind and, by so doing, improve the public's demand for all plastics products.

While this is an entirely worthwhile project, it must be emphasized that education, like charity, begins at home. How can the consumer education program be successful when so much plastics "junk" and other misapplications or non-engineered products still flood the retail market? What good is telling the consumer how plastics can serve in products that give excellent service when many of the plastics items he or she may see in the stores will only confirm and strengthen his previous poor opinion of plastics?

•

The program of educating the consumers about plastics can be successful only if the plastics processors, the companies who manufacture the products that the public will see in the retail stores, are themselves educated to make only engineered products.

Needless to say, an engineered plastic product is not necessarily an industrial product. Any item that is properly designed and is made of a material whose properties meet the service requirements of the part is an engineered product. Obviously, this definition precludes both misapplications of a plastic material and improper design of a finished product.

There are plastics misapplications that are unintentional on the part of the processor. Even with the best of intentions, the processor may mold the desired properties right out of the material simply because he does not know any better or has not been adequately informed by his materials salesman in the latter's anxiety to make the sale.

Unfortunately, however, most plastics misapplications are deliberate on the part of the processor. It is well-known and regrettable that nearly all of the technical work done at the processor level is aimed at copying and cheapening, thereby underselling, the competitor's product. This cheapening process involves (1) using a less costly material, regardless of the fact that its properties may not be adequate for the application; and (2) thinning down the wall cross-sections of the part and making other design changes that will permit a lower manufacturing cost.

This process is made easy for the processor if the part in question does not have stringent service requirements or is sold to the consumer who can be fooled into mistaking color or outward appearance for quality.

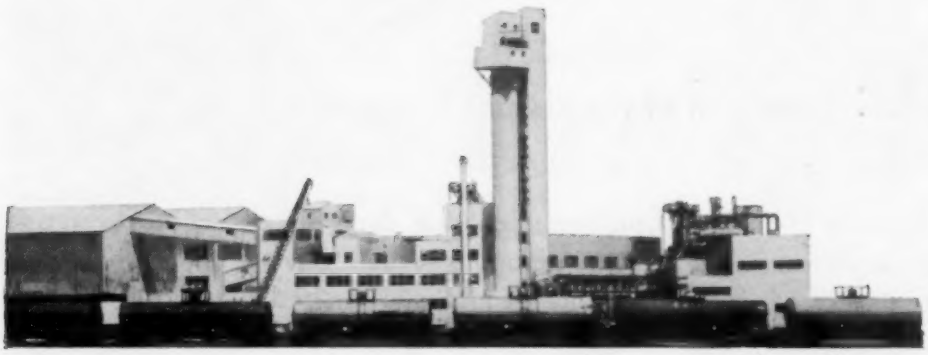
•

It is apparent that the plastics processing industry is sadly in need of education on its materials and their applications. Before educating the public about plastics, the plastics industry should first heed the wisdom of the injunction, "Physician, heal thyself!"

Arthur M. Merrill

Editor

your Two best sources for UREA



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PLASTICS TECHNOLOGY

Effect of Fillers in Polyethylene

A study of the effects of 26 fillers on the physical properties of a medium molecular weight polyethylene resin.

W. J. FRISSELL, *Development Department*
Bakelite Co., Bound Brook, N.J.

PREVIOUS work in this laboratory by Bostwick and Carey* has shown that inorganic fillers have a reinforcing effect in polyethylene, just as they do in other plastic resins. There are a number of attractive applications for filled polyethylene, such as hot water pipe, thermos bottle caps, electrical insulation, molded articles, kitchenware, and floor tile. Reduction of cost through the use of fillers should also be feasible in some applications.

The object of this study was to define the effects of a range of filler types on the properties of polyethylene. Primary emphasis was placed on physical properties, but effects on compound color and light stability were given only cursory examination.

Test Procedure

The resin used for this evaluation was Bakelite polyethylene resin DYNH, a medium molecular weight material with a melt index of 1.5-2.4 grams/10 minutes.

A list of the 26 fillers evaluated is given in Table 1, along with their respective compositions and suppliers. All of the fillers are commercially available, except the

* Bostwick, R., and Carey, R.H., **Ind. Eng. Chem.**, 42 848 (1950).

Warren J. Frissell, Jr., was born in Dubuque, Iowa, in 1923. He attended the University of Dubuque and Iowa State College, receiving a B. S. in chemical engineering in 1948. From 1944-46, he was employed by Tennessee Eastman Co. at Oak Ridge, Tenn., and joined Bakelite in 1948 as a chemical engineer in the development department. He is a member of Tau Beta Pi. Mr. Frissell currently resides in Plainfield, N. J., with his wife and son.

Table 1. Fillers Tested in Polyethylene.

No.	Name	Composition	Supplier
1.	Aluminum Hydrate C-741	Aluminum trihydrate, surface coated.	Aluminum Co. of America.
2.	Asbestos fibers	Mixed fibers (South Africa).	———
3.	Asbestos Shorts 7R	Short asbestos fibers.	Johns-Manville Corp.
4.	Atomite	Wet-ground calcium carbonate.	Thompson, Weinman & Co.
5.	Bentone 34	Basic clay.	National Lead Co.
6.	Cab-O-Sil	Very fine (0.020-micron) collodial silica.	Godfrey L. Cabot, Inc.
7.	Dicalite Super-Aid	Diatomaceous earth.	Dicalite Div., Great Lakes Carbon Corp.
8.	Fibrous Magnesium Silicate #380	———	Whittaker, Clark & Daniels, Inc.
9.	Fibrous Talc 6N	Fibrous talc.	International Talc Co., Inc.
10.	Glass Fibers: "A"	1/2-In. chopped strand, Silane treated.	Owens-Corning Fiberglas Corp.
11.	"B"	1/2-In. chopped strand, heat cleaned.	Owens-Corning Fiberglas Corp.
12.	"C"	1/8-In. milled fibers, Silane treated.	Owens-Corning Fiberglas Corp.
13.	"D"	1/8-In. chopped strand, Silane treated.	Pittsburgh Plate Glass Co.
14.	Glass Film: "A"	Double flakes 8-microns thick, untreated.	Owens-Corning Fiberglas Corp.
15.	"B"	Same as film "A," but treated with polyisobutylene.	Owens-Corning Fiberglas Corp.
16.	"C"	Same as film "A," but treated with compatible phenolic.	Owens-Corning Fiberglas Corp.
17.	"D"	Same as film "A," but treated with phenyl silane.	Owens-Corning Fiberglas Corp.
18.	"E"	Same as film "A," but treated with vinyl silane.	Owens-Corning Fiberglas Corp.
19.	Hi-Sil 110	Precipitated hydrous silica (0.025 micron).	Columbia-Southern Chemical Corp.
20.	Iceberg pigment	Calcined clay.	Burgess Pigment Co.
21.	Micronex W-6	Beaded channel black.	Binney & Smith, Inc.
22.	Multiflex MM	Precipitated calcium carbonate.	Diamond Alkali Co.
23.	Santocel C	Hydrated silica.	Monsanto Chemical Co.
24.	Satintone	Calcined clay.	Minerals & Chemicals Corp.
25.	Silene EF	Precipitated calcium silicate.	Pittsburgh Plate Glass Co.
26.	Sno-Brite	Uncalcined clay.	Thompson, Weinman & Co.

asbestos fibers from South Africa and the glass film. The latter is a development-scale product of Owens-Corning Fiberglas Corp.

Preparation of Samples

Filler and resin were blended for five minutes in a Hobart kitchen-type mixer. A total batch weight of 400 grams was used. The blend was fluxed on an 8 by 16-inch two-roll laboratory mill at 120° C. (steam outlet temperature), and rolled for 15 minutes. The resulting sheet was molded into appropriate plaques for the various tests.

Test Methods

Tensile properties at 23 and 80° C. were measured using a Baldwin-Tate-Emery Universal Testing Machine. Specimens were cut with die "A" of ASTM D412-51T. A strain rate of 1.0 inch/minute was used until the yield point was passed, then the rate was increased to 20 inches/minute until the specimen broke. The properties reported from this test are tensile strength, yield strength, ultimate elongation at yield point.

Secant modulus at 23° C. was measured with the same test method, but at a strain rate of 0.1 inch/minute. The secant modulus was taken as the slope of the line intersecting the stress-strain curve at the origin and 1.0% strain.

Heat distortion temperature was determined in accordance with ASTM method D648-45T using a stress of 66 psi.

Durometer "D" hardness was determined by the method of ASTM D676-49 using a 3.2-pound weight and taking the reading after 15 seconds contact.

Brittle temperature (50% index) was run by modification of ASTM method D746-44T intended for use with materials having a wide transition range.

X1A failure was determined in the Atlas X1A Weatherometer.

Zero-strength time is a type of creep test run above the softening point of the polymer. For this study, it was run at a temperature of 127° C. and a stress of 5.6 psi. The time to failure, in seconds, is recorded.

The guillotine test was developed by Worthington Ball Co. to test the cutting resistance of golf ball covers. The apparatus is essentially a miniature guillotine. Depth of cut edgewise into a 0.125-inch thick sample is measured.

Stress rupture was measured by loading a 1/8-inch thick specimen in tension at a stress of 600 psi. and a temperature of 60° C. Time to failure, in days, and approximate per cent strain at failure were recorded.

Table 2. Tensile and Yield Properties at 23° C. of Filled Polyethylene at Various Loadings.

Filler No.	Filler concentration, phr.:	Tensile Strength at 23° C., Psi.				Yield Strength at 23° C., Psi.				Ultimate Elongation at 23° C., %				Elongation at Yield Point at 23° C., %			
		5	20	50	100	5	20	50	100	5	20	50	100	5	20	50	100
1.		1680	1460	1460	1380	1340	1370	1410	1380	565	360	65	2	76	60	20	12
2.		—	1860	2530	2390	—	1770	2530	2390	—	22	15	5	—	12	12	1
3.		1480	1520	1660	1760	1340	1360	1660	1760	355	140	25	6	67	20	10	2
4.		1870	1480	1450	1510	1340	1350	1450	1510	590	630	110	30	65	50	20	10
5.		1790	1560	1530	1440	1280	1380	1530	1440	590	160	36	0	65	10	8	0
6.		—	1740	1900	—	—	1540	1900	—	—	102	7	—	—	35	6	—
7.		1540	1650	1840	2170	1360	1530	1840	2170	600	130	26	9	57	40	17	5
8.		1450	1540	1790	1980	1350	1430	1790	1980	440	110	22	4	60	22	15	3
9.		—	1730	1910	2110	—	1520	1720	2050	—	98	49	19	—	40	17	10
10.		—	1890	2680	3050	—	1890	2680	3050	—	28	16	5	—	12	10	5
11.		—	1580	1820	1790	—	1410	1790	1790	—	65	15	3	—	10	6	2
12.		—	1880	1980	2100	—	1860	1970	2100	—	22	13	5	—	7	7	1
13.		—	1490	1510	1510	—	1260	1510	1510	—	270	16	3	—	12	4	2
14.		—	1550	1770	—	—	1450	1770	—	—	34	8	—	—	6	3	—
15.		—	1600	1820	1540	—	1430	1790	1540	—	169	23	0	—	8	5	0
16.		—	1610	2060	2300	—	1520	1970	2300	—	43	27	0	—	20	8	0
17.		—	1750	1760	1600	—	1730	1710	1600	—	14	15	0	—	2	2	0
18.		—	1710	1980	2270	—	1540	1900	2270	—	41	19	0	—	12	2	0
19.		1690	1630	1930	1150	1350	1540	1920	1150	545	185	15	0	65	40	10	0
20.		—	1750	1690	1950	—	1550	1640	1950	—	169	45	10	—	50	24	9
21.		1350	1690	1810	1390	1310	1500	1810	1390	99	460	14	0	40	50	7	0
22.		1890	1430	1310	1390	1330	1330	1310	1390	585	585	55	15	70	60	20	15
23.		—	1600	1800	—	—	1450	1800	—	—	87	12	—	—	18	11	—
24.		1710	1550	1730	1840	1350	1460	1650	1840	630	195	100	20	70	65	40	10
25.		1460	1560	1670	1730	1330	1430	1670	1730	380	87	13	5	55	20	12	5
26.		—	1640	1650	2150	—	1450	1650	2150	—	197	16	10	—	53	7	8
	None (control)	1670	—	—	—	1310	—	—	—	560	—	—	—	72	—	—	—

Table 3. Tensile and Yield Properties at 80° C. of Filled Polyethylene at Various Loadings.

Filler No.	Filler concentration, phr.:	Tensile Strength at 80° C., Psi.				Yield Strength at 80° C., Psi.				Ulimate Elongation at 80° C., %				Elongation at Yield Point at 80° C., %			
		5	20	50	100	5	20	50	100	5	20	50	100	5	20	50	100
1.		590	520	415	330	545	485	415	330	636	197	57	20	75	57	52	16
2.		—	600	715	825	—	600	715	825	—	44	14	8	—	40	15	8
3.		505	470	555	570	485	455	550	570	201	104	51	23	83	62	45	23
4.		610	595	590	505	575	595	590	505	398	192	63	14	67	60	53	11
5.		505	485	430	350	475	460	420	350	440	275	110	15	95	85	80	15
6.		—	630	660	—	—	630	660	—	—	81	18	—	—	65	12	—
7.		470	510	580	615	435	480	580	615	188	108	31	12	65	65	31	12
8.		520	555	685	675	485	535	685	675	285	83	33	11	77	53	33	11
9.		—	600	650	750	—	600	650	750	—	94	54	18	—	62	30	15
10.		—	615	795	890	—	580	790	890	—	80	10	4	—	8	7	4
11.		—	580	680	570	—	550	680	570	—	125	14	10	—	70	9	7
12.		—	620	745	825	—	600	745	825	—	98	15	17	—	13	15	8
13.		—	530	450	360	—	520	450	360	—	167	52	36	—	110	13	5
14.		—	540	645	—	—	525	645	—	—	54	26	—	—	30	20	—
15.		—	525	605	620	—	525	605	620	—	38	23	8	—	33	17	8
16.		—	635	705	815	—	615	705	815	—	86	21	9	—	50	16	9
17.		—	640	605	630	—	630	595	630	—	35	31	7	—	20	15	7
18.		—	630	700	945	—	600	700	945	—	79	21	11	—	42	20	11
19.		545	670	705	345	515	635	705	345	303	100	25	0	90	58	25	0
20.		—	730	760	850	—	670	710	850	—	187	96	32	—	60	50	28
21.		490	635	715	595	455	545	680	595	290	770	203	13	70	87	62	13
22.		610	610	540	445	575	580	515	445	351	170	80	8	77	60	37	8
23.		—	585	590	—	—	580	590	—	—	61	10	—	—	52	9	—
24.		600	575	635	650	570	540	635	650	528	191	61	22	90	75	60	22
25.		605	520	540	570	580	520	540	570	153	74	25	5	77	65	25	5
26.		—	645	700	805	—	605	675	805	—	208	107	50	—	80	60	45
	None (control)	635	—	—	—	545	—	—	—	540	—	—	—	81	—	—	—

Table 4. Secant Modulus, Heat Distortion, and ZST Values for Filled Polyethylene at Various Loadings.

Filler No.	Filler concentration, phr.:	Secan Modulus at 23° C., Psi. x 10^{-3}				Heat Distortion Temp. at 66 Psi., °C.				Zero Strength Time at 127° C., Sec.			
		5	20	50	100	5	20	50	100	5	20	50	100
1.		26	28	34	44	40	39	40	45	250	250	240	780
2.		—	48	83	108	—	53	72	69	—	260	280	310
3.		31	40	58	81	44	46	56	62	220	220	270	>860
4.		29	33	38	56	38	38	43	48	280	270	270	260
5.		30	—	47	112	46	46	54	63	210	240	360	—
6.		—	39	76	—	—	64	77	—	—	240	>600	—
7.		—	42	64	92	44	44	57	69	220	230	220	230
8.		—	39	58	91	42	46	59	67	220	230	240	240
9.		—	36	50	78	—	59	60	72	—	200	190	200
10.		—	64	108	166	—	61	84	94	—	240	330	360
11.		—	44	76	93	—	68	85	82	—	210	220	230
12.		—	55	77	125	—	54	85	88	—	270	280	300
13.		—	44	69	89	—	56	70	88	—	220	210	230
14.		—	46	78	—	—	58	68	—	—	240	250	—
15.		—	58	92	123	—	59	71	80	—	250	230	250
16.		—	55	89	137	—	56	70	81	—	240	230	250
17.		—	76	80	108	—	65	66	78	—	250	250	250
18.		—	52	83	132	—	57	69	83	—	250	260	250
19.		28	38	70	129	45	49	62	85	240	260	>860	>860
20.		—	33	43	72	—	53	60	67	—	200	200	190
21.		31	40	67	94	47	50	54	68	210	240	>860	>860
22.		29	33	43	66	39	42	46	56	260	260	260	250
23.		—	41	66	—	—	49	61	—	—	320	>860	—
24.		25	33	48	71	40	43	49	62	260	260	250	240
25.		30	39	60	132	44	50	59	86	210	220	240	>860
26.		—	35	56	90	—	49	60	72	—	250	260	400
	None (control)	26	—	—	—	43	—	—	—	260	—	—	—

Table 5. Hardness, Cut Resistance, and Color of Filled Polyethylene at Various Loadings.

Filler No.	Filler concentration, phr.:	Durometer "D" Hardness				Guillotine Test Depth of Cut, Mm.				Color Imparted by Filler
		5	20	50	100	5	20	50	100	
1.		49	49	51	54	13	12	11	11	White
2.		—	52	55	60	—	11	9	Split	Dark gray
3.		45	48	52	55	16	12	12	10	Dark gray
4.		48	49	51	55	12	12	11	11	Grayish white
5.		45	47	50	53	13	12	13	Split	Tan
6.		—	52	59	—	—	11	8	—	Very light tan
7.		44	49	54	60	12	13	10	9	Brown
8.		44	47	51	55	16	14	12	—	Gray
9.		—	48	51	57	—	13	12	10	Light gray
10.		—	54	59	61	—	11	10	9	Light gray
11.		—	49	54	57	—	13	12	11	Light gray
12.		—	52	56	60	—	11	10	Split	Light gray
13.		—	49	53	58	—	13	11	Split	Light gray
14.		—	50	54	—	—	12	11	—	Light gray
15.		—	48	51	59	—	12	11	Split	Light gray
16.		—	49	54	59	—	12	11	Split	Light gray
17.		—	52	54	59	—	11	11	Split	Light gray
18.		—	50	55	58	—	12	11	Split	Light gray
19.		48	53	57	67	12	10	8	6	Light gray
20.		—	49	52	56	—	13	11	10	White
21.		47	50	55	65	15	12	10	6	Black
22.		48	49	52	56	14	12	12	Split	Cream
23.		—	50	57	—	—	11	9	—	Light tan
24.		48	50	54	58	14	12	11	10	Light gray
25.		46	49	55	63	13	12	10	8	Light gray
26.		—	49	52	54	—	11	10	8	Cream
	None (control)	46	—	—	—	14	—	—	—	White

Test Results

Yield and Ultimate Tensile

Four properties were measured with the tensile test: ultimate tensile strength, ultimate elongation, yield strength, and elongation at yield point. Since the yield point for most applications is the point of failure, the yield properties are considered more significant than the ultimate tensile properties. Tensile tests were run at both 23 and 80° C., with the results shown in Tables 2 and 3. Concentration of filler is shown in parts per hundred of resin.

In general, the tensile properties at 23° C. were slightly affected by the addition of five parts of filler. Twenty parts of filler lowered the elongation, but had very little effect on tensile strength and yield strength. However, both 50 and 100 parts of filler reduced elongation sharply and, in most cases, raised the yield and tensile strengths. Glass fibers "A" (Filler No. 10) raised yield strength to almost twice that of unfilled resin at a concentration of 100 parts. Other fillers which were particularly good in raising yield strength were asbestos fibers (No. 2), Dicalite Super-Aid (No. 7), glass film samples "C" and "D" (Nos. 16 and 18), and Sno-Brite (No. 26).

With most of the fillers, increased concentration resulted in higher yield strength. However, in some cases, the yield strength was lower at 100 parts filler than at 50 parts. Two examples of the latter behavior occur with Hi-Sil 110 precipitated hydrous silica (No. 19) and Micronex W-6 carbon black (No. 21). Apparently, in these cases, the surface area of the filler is so great that it cannot be wetted adequately by the resin. As a result, the compound is lacking in strength.

It is interesting to note that at filler concentrations of 50 and 100 parts, the yield strength and ultimate tensile strength are usually the same; the ductibility normally associated with polyethylene is missing; and the compound breaks very soon after it yields.

In general, the same behavior is found at 80° C. as at 23° C. Of course, the yield strength is much lower at 80° C. The elongation figures are of the same order, although at 100 parts of filler they are higher at 80° than at 23° C. At 80° C., the degree of increase in yield strength caused by the better fillers is not as great as at 23° C. The same fillers are generally good, with the exception of Dicalite Super-Aid (No. 7). The phenomenon of a lower yield strength at 100 parts than at 50 parts is also found at 80° C., notably with Hi-Sil 110 (No. 19).

Modulus of Elasticity

In all cases, the secant modulus at 23° C. showed a rise with increasing filler concentration (see Table 4). At five parts phr., the fillers had little effect, but 20 parts raised the modulus as much as 300% in one case. The highest modulus, 166,000 psi., was found with 100 parts of glass fibers (No. 10). The result for unfilled resin was 26,000 psi.

Other fillers which produced a high modulus were asbestos fibers (No. 2), Bentone 34 basic clay (No. 5), glass fibers "C" (No. 12), the glass films (Nos. 14-18), Hi-Sil 110 (No. 19), and Silene EF precipitated calcium silicate (No. 25). Atomite calcium carbonate (No. 4), and Aluminum Hydrate C-741 (No. 1) had the least effect on modulus.

Heat Distortion Temperature

Increases in heat distortion point ranged from 51° C. for glass fibers "A" (No. 10) to two degrees for Aluminum Hydrate C-741 (No. 1), as shown in Table 4. The most effective fillers here were the glass fibers (Nos. 10-13), the glass films (Nos. 14-18), Hi-Sil 110 (No. 19), and Silene EF (No. 25). It seems reasonable to expect a correlation between heat distortion temperature and yield strength at 80° C. This, along with other possible correlations, is discussed in a later section.

Zero-Strength Time (ZST)

Results of this test (see Table 4) fall into two categories. Most of the filled compounds were not significantly different from the unfilled resin, but a few showed comparatively long zero-strength times. These were Aluminum Hydrate C-741 (No. 1), Asbestos Shorts 7R (No. 3), Cab-O-Sil silica pigment (No. 6), Hi-Sil 110 (No. 19), Micronex W-6 (No. 21), Santocel C hydrated silica (No. 23), and Silene EF (No. 25). The longer ZST values were found only at 50 or 100 parts of filler.

Durometer Hardness

As shown in Table 5, the effect of fillers on Durometer "D" hardness was generally much less than effect on other properties. The highest hardness value found was 67 for a loading of 100 parts phr. of Hi-Sil 110 (No. 19), as compared with 46 for unfilled resin. The differences among fillers on the hardness properties also were smaller than with other properties. The high hardness value of 67 was somewhat below that of a rigid vinyl sheet which is around 80.

Guillotine Test

The resistance to cutting, as measured by this test, was approximately doubled by the most effective fillers, as shown in Table 5. These were Hi-Sil 110 (No. 19) and Micronex W-6 (No. 21). Many of the compounds containing 100 parts of filler actually split, showing a definite brittle fracture.

Brittle Temperature

As shown in Table 6, the test for brittle temperature at 50% index was run on only five fillers so no over-all comparisons can be made. However, it is obvious that the effect of any filler will be to raise the brittle temperature drastically, especially at the higher loadings. Of the fillers tested, Iceberg pigment (No. 20) had the least effect.

In connection with brittle temperature, it should be realized that the use of a filler changes polyethylene from a flexible material to one which is essentially rigid. The brittle temperatures of rigid plastics are usually above room temperature, and the brittle temperature test may be of questionable value.

Table 6. Brittle Temperature, Stress Rupture, and Weatherometer Values for Filled Polyethylene at Various Loadings.

Filler		Brittle Temp. 50% Index, °C.	Stress Rupture at 600 Psi. and 60° C.		X1A Weatherometer Failure	
No.	Concentration		Time to Failure, Days	Approx. Strain at Failure, %	Hours	Type
3	50	—	>274	>15.9	—	—
5	50	—	16	20.0	—	—
6	20	−18	—	—	500	Crazing
	50	>25	—	—	240	Crazing
7	50	—	59	7.5	—	—
8	50	—	3	7.0	—	—
9	20	−36	—	—	750	Crazing
	50	−14	—	—	750	Crazing
	100	>25	—	—	500	Crazing
11	20	−34	—	—	750*	Slight darkening, White streaks
	50	10	—	—	750	White streaks
	100	>25	—	—	500	White streaks
12	50	—	70	3.5	—	—
	100	—	105	1.0	—	—
13	20	−36	—	—	750*	Slight yellowing
	50	8	—	—	750	White streaks
	100	>25	—	—	750	White streaks
19	50	—	96	6.5	—	—
20	20	−64	—	—	500	Crazing
	50	−25	—	—	500	Crazing
	100	3	—	—	500	Crazing
21	50	—	0	—	—	—
24	100	—	2	5.0	—	—
Control	—	−98	2	39.1	750*	Slight darkening

* These samples are not considered to have failed.

Stress Rupture

As shown in Table 6, straight resin shows the very short life of two days when tested for stress rupture at 600 psi. and 60° C. Three of the fillers, Satintone calcined clay (No. 24), Micronex W-6 (No. 21), and fibrous magnesium silicate (No. 8) did not improve this performance. Among the other fillers tested, Asbestos Shorts 7R (No. 3) was the best with a life of over 274 days at the comparatively low strain of 15.9%. Glass fibers "C" (No. 12) and Hi-Sil 110 (No. 19), which lasted 105 and 96 days respectively, also were very good.

It is apparent that properly chosen fillers can greatly improve the long-time strength of polyethylene resin.

Light Stability

A cursory study of the effects of five different fillers on the light stability of the resin was made using the X1A Weatherometer (see Table 6). After 750 hours exposure, straight resin showed only a slight discoloration. All of the samples containing Cab-O-Sil (No. 6), Fibrous Talc 6N (No. 9), or Iceberg Pigment (No. 20) showed severe crazing at or before this exposure time.

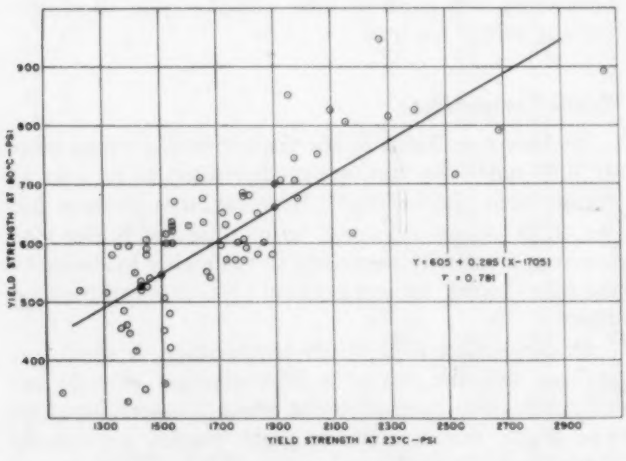


Fig. 1. Correlation between yield strengths at 23° C. and 80° C.

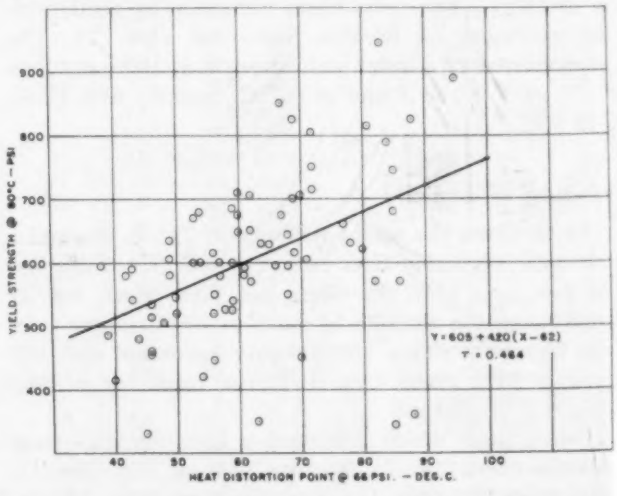


Fig. 2. Correlation between yield strength at 80° C. and heat distortion at 66 psi.

The samples containing either of the glass fibers (Nos. 12 and 13) showed a curious white streaking effect in the exposed area which seemed like an erosion of the surface. The use of the fillers tested was definitely detrimental to the light stability of the resin.

Color Imparted by Filler

Most of the fillers imparted comparatively little color to the polyethylene, as shown in Table 5. However, the coloring effect of such materials as Micronex W-6 carbon black (No. 21) and the asbestos fillers (Nos. 2 and 3) would definitely limit their use. Of the fillers tested, the glass fibers (Nos. 10-13) and glass films (Nos. 14-18) had the least opacifying effect.

Summary of Properties

To permit quick comparisons of fillers, a summary chart has been constructed and is shown in Table 7. A numerical rating system has been used as follows:

(1) The filler had no effect as compared with unfilled resin.
(2) Slight effect.
(3) Moderate effect.
(4) Large effect.
(5) Very large effect.

In using a chart such as this, a specific application must be kept in mind. For example, if the modification of resin to make it suitable for boilable articles is being considered, an increase in modulus, heat distortion, and yield strength at 80° C. are required. The desired filler should have a large effect on these and related properties, combined with a small effect on other properties.

In a second case, it may be desired to simply lower the cost by addition of a filler. Here the least effect on all properties is required. For the first application, the chart shows glass fibers "A" (No. 10) to be a good choice. For the second application, Aluminum Hydrate C-741 (No. 1) Atomite (No. 4), or Satintone (No. 24) would be indicated.

Correlation Among Tests

A number of graphs of related properties plotted against one another have been made to check correlations. These graphs contain data on compounds with 20, 50 and 100 parts of filler, and are shown in Figures 1-4. Least square lines and correlation coefficients were calculated in each case. A correlation coefficient of 1.00 represents a perfect correlation.

Figure 1 shows yield strength at 23° C. vs. yield strength at 80° C. There is some scatter, but the correlation is fairly good throughout the graph. The correlation coefficient is 0.78. in Figure 2, yield strength at

(Continued on page 746)

Table 7. Numerical Ratings of Fillers by Effects on Polyethylene Properties at 50-Part Loading.

No.	Filler Name	At 23°C.		At 80°C.										
		Yield Strength	Yield Point Elongation at	Yield Strength	Elongation at Yield Point	Secant Modulus at 23° C.	Heat Distortion Temperature	Zero Strength Time	Durometer "D" Hardness	Guillotine Test	Brittle Temperature	X1A Weatherometer	Color Imparted	Stress Rupture at 600 Psi. and 60°
1.	Aluminum Hydrate C-741	1	4	1	2	2	1	1	3	3	—	—	1	—
2.	Asbestos Fibers	5	5	4	5	4	4	1	4	5	—	—	4	—
3.	Asbestos Shorts 7R	2	5	1	3	3	3	1	3	3	—	—	4	5
4.	Atomite	1	4	1	2	2	1	1	3	3	—	—	2	2
5.	Bentone 34	2	5	1	1	2	2	2	2	2	—	—	3	—
6.	Cab-O-Sil	3	5	3	5	4	5	5	5	5	5	4	2	—
7.	Dicalite Super-Aid	3	4	1	4	3	3	1	4	4	—	—	3	3
8.	Fibrous Magnesium Silicate #380	3	5	3	4	3	3	1	3	3	—	—	3	1
9.	Fibrous Talc 6N	2	4	3	4	3	3	1	3	3	4	2	2	—
10.	Glass Fibers "A"	5	5	5	5	5	5	2	5	4	—	—	2	—
11.	"B"	3	5	3	5	4	5	1	4	3	5	2	2	—
12.	"C"	3	5	5	5	4	5	1	4	4	—	—	2	4
13.	"D"	2	5	1	5	4	4	1	3	4	5	2	2	—
14.	Glass Film "A"	2	5	3	5	4	4	1	4	4	—	—	2	—
15.	"B"	3	5	2	5	5	4	1	3	4	—	—	2	—
16.	"C"	3	5	4	5	5	4	1	4	4	—	—	2	—
17.	"D"	2	5	2	5	4	4	1	4	4	—	—	2	—
18.	"E"	3	5	4	5	4	4	1	4	4	—	—	2	—
19.	Hi-Sil 110	3	5	4	4	4	3	5	5	5	—	—	2	4
20.	Iceberg Pigment	2	4	5	3	2	3	1	3	4	3	3	1	—
21.	Micronex W-6	3	5	4	2	3	2	5	4	4	—	—	5	1
22.	Multifex MM	1	4	1	3	2	2	1	3	3	—	—	2	—
23.	Santocel C	3	5	1	5	3	3	5	5	5	—	—	2	—
24.	Santintone	2	3	2	2	2	2	1	4	4	—	—	2	1
25.	Silene EF	2	5	1	4	3	3	1	4	4	—	—	2	—
26.	Sno-Brite	2	5	4	2	3	3	1	3	4	—	—	2	—

L. D. RICHARDSON, *Technical Information Service, Eutectic Welding Alloys Corp. Flushing, New York*

Maintenance Welding in the Plastics Industry—Part II

The conclusion of a two-part article on how effective maintenance welding can reduce operational costs and capital investment

Salvage of Molds

One of the great opportunities for reducing overhead in the plastics field is in the salvage of molds. Molds are costly, and usage, mishap, and wear often cause fine detail to wash out, fractures may occur, and edges may chip. Repair of molds by welding is of great interest because not infrequently, a few ounces of weld metal, costing only pennies, may save a mold costing many dollars.

Steel Molds

Steel molds can be welded and fabricated in practically any shop, large or small. All that are needed are either an arc welding machine, an oxy-acetylene torch, or inert gas-shielded arc welding equipment, and a welder who will follow a few basic rules.

Many years of trial and comparison have shown that while oxy-acetylene welding of molds is often perfectly satisfactory, it does have certain limitations which make it unsuitable in many applications. First of all, in almost all cases, the part to be welded must be brought up to red heat before the filler metal can be applied. In the case of inert gas-shielded arc welding, the base metal must be raised to fusion temperature. This consumes disproportionate amounts of heating time, especially in the case of larger parts. In addition, it becomes a major problem to avoid annealing of the base metal adjacent to the weld area. All in all, gas welding of molds is generally a much costlier, lengthier, and trickier procedure than arc welding with an equivalent tool steel electrode. The latter method is usually preferred, the more so since it offers better control of the heat in the base metal during all phases of the repair or fabrication.

Today, welding in the tool-room is not limited to mold repairs of breakage and wear only. Research and practical work in the field have proven that tool-room

welding pays big dividends in mold repair, rectification of machining errors, composite mold construction, and facilitation of design changes.

In repairing of molds, the damaged mold should first be examined very carefully to determine the depth the fracture is. Following this preliminary examination, all the known facts about the die steel base metal should be compiled. Most of the steels commonly used in molds can be classified according to their response to heat-treatment, and five types of welding alloys are sufficient to handle all contingencies. The basic classifications of tool steel are listed in Table 1, together with the appropriate electrode or gas rod to be used.

Table 1. Types of Tool Steels and Recomended Welding Rods

Tool Steel Type	EutecTrode Welding Electrode	EutecRod Gas Welding Rod
Oil Hardening	6-OH AC-DC	5-OH
Air Hardening	6-SH AC-DC	5-AH
Water Hardening	6-WH AC-DC	5-WH
Hot Working	6-HW AC-DC	5-HW
High Speed	6-HSS AC-DC	5-HSS

Quite often, information as to the type of steel or heat-treatment used in a particular mold is not readily available and cannot be determined easily. Fortunately, answers to the following five questions will usually provide the necessary clues to permit a correct and successful repair:

(1) What type of mold?

(2) What is the Rockwell or Brinell hardness of the mold?

(3) From what temperature was the mold quenched, and in which quenching medium? (Of all the molds used today, the greater percentage are of oil-hardening steel because of the low distortion rate when hardened).

(4) What was the tempering range?

(5) How long was the mold in service before it broke down or chipped? (This question will not reveal the type of steel used, but is very important for other considerations).

Spark testing is another very simple, but highly useful means of identification. If any non-critical portion of the tool or mold can be held with light to medium pressure against a grinding wheel for a few seconds, the spark pattern will go far in definitely establishing the type of steel.

A visual examination of the cracked mold may be started with a magnifying glass or, better still, by Magnaflux apparatus to determine the extent of the damage in the defective area. A new commercial process called Dy Chek also may prove useful. All cracks thus located should be ground sufficiently deep to permit two or three passes of the welding alloy, making sure that sharp corners and all fatigue cracks in the weld area are removed.

As a general recommendation in the choice of grinding wheels, the following types might be kept in mind: for dry off-hand grinding by straight wheel, use Type A46H8V; for wet surface grinding by straight wheel, use Type A46J5V (also can be used dry, although wet is preferred); and for wet surface grinding by cup wheel, use Type A30H8V. Any reasonable equivalent of these wheels is satisfactory provided it is soft enough so as not to glaze on the hardened steel, and that no grinding particles become embedded in the mold metal. Surface speed should not exceed about 6,000 feet per minute. In grinding, the usual care should be exercised to avoid the formation of grinding checks.

The next and most important phase of preparation is mold preheating. The mold should be heated to within 150° F. of the draw temperature, or to some temperature in the ranges shown below for the four classifications of die steels:

Oil hardening	300-400° F.
Air hardening (high carbon, high chromium)	600-900° F.
Water hardening	250-450° F.
Hot working (tungsten-chromium)	700-900° F.

Preheating can be accomplished most satisfactorily in temperature-controlled furnaces which assure even, accurate temperatures. Another way to determine the preheat temperature is to use Tempilstiks**. These crayons will accurately indicate a specific temperature in the base metal within 1% of rated temperature. If Tempilstiks are not available, the base metal can be watched for the following color ranges:

Light straw	400° F.
Dark straw	475° F.
Copper	520° F.
Purple	550° F.
Light blue	640° F.
Red (in dark room)	900° F.

For best results, it is recommended that Eutecto-Mask* be painted all around the repair area before starting the preheat. This newly developed masking compound protects the area adjacent to the weld from heat, flames, spatter, etc., and insures a clean, non-pitted surface after the repair is completed. Preheating should be handled with care, especially with molds of intricate design. Due to the fact that the mold is in a hardened state, it cannot bend or give, so that it may be cracked by thermal stresses caused by uneven heating. It is suggested, therefore, that preheating be accomplished in small, even increments, allowing the mold to come up to temperature each time, so as to minimize temperature gradients.

Whereas preheating in a furnace is preferred, it is not essential. An oxy-acetylene torch with a soft carburizing flame (excess acetylene) or even an ordinary hot plate may be and is used in most repairs. The torch is kept in motion until the heat has permeated the mold and there are no cold spots left.

After these preparations have been made, the actual

*Trademark of Eutectic Welding Alloys Corp.
**Products of the Tempil Corp.

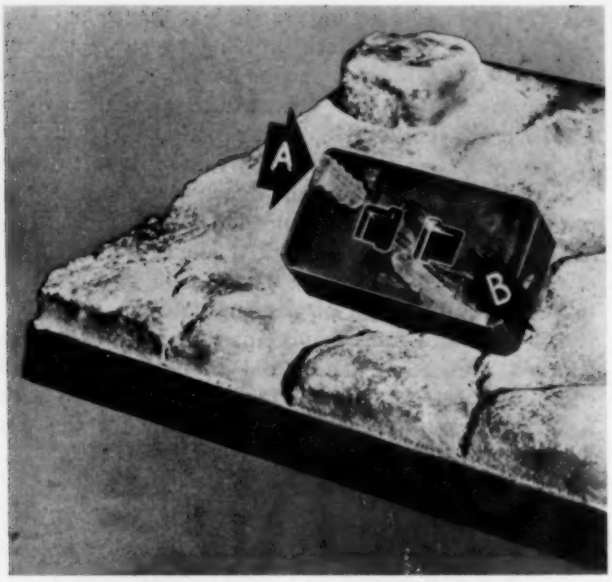


Fig. 5. Female half of tool steel mold for phenolic parts shown after repair of mold cracks.

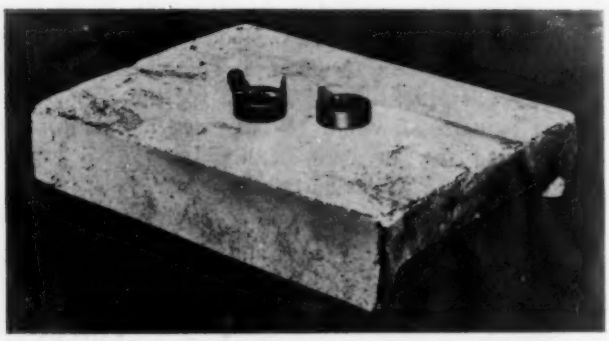


Fig. 6. Plastic mold has broken section rebuilt by welding.

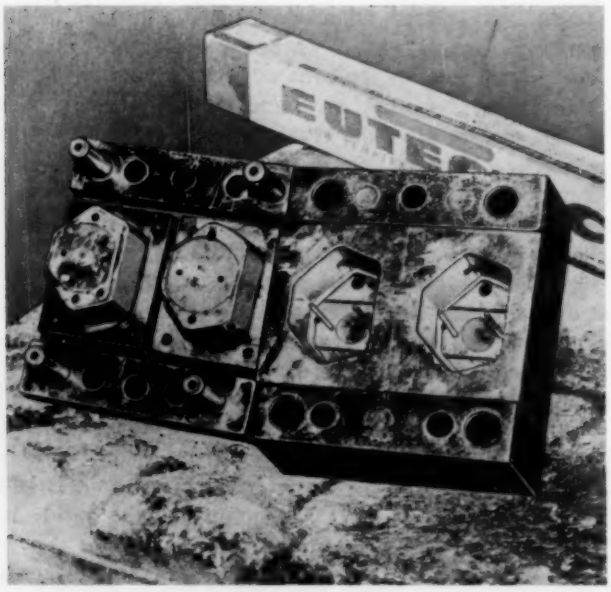


Fig. 7. Matched mold set after worn edges were rebuilt to original shape by welding.

welding operation can begin. In many cases it is advisable to deposit one or two layers of "cushion" alloy before applying the final tool steel electrode. Not only does this "cushion" alloy effect greater economies, but it also minimizes or completely eliminates the danger of underbead cracking in the weld area. An excellent "cushion" alloy for all steel molds is EutecTrode 680 AC-DC. The $\frac{3}{32}$-inch size is used on small repairs, while the $\frac{1}{8}$-size is used on larger molds. This austenitic electrode bonds at low base-metal heat without undercutting and with a minimum dilution of the base metal.

The next step is depositing the proper tool steel electrode. No special trick weaving is required with any of the EutecTrodes for tool steel; in fact, it is neither necessary nor desirable. A close arc should be held with the electrode at an angle of 75-90° to the base metal. The arc is always held on the weld deposit to keep the heat in the base metal at a minimum.

To simplify welding and minimize fatigue, tilt the mold at an angle of about 30°. After establishing the correct amperage on a piece of scrap metal, start the weld on the same piece of scrap and then transfer to the mold proper in order to eliminate the effects of a long starting arc. When rebuilding a square corner, hold the arc slightly in back of the corner and allow the deposit to wash over the edge.

A technique which minimizes formation of weld craters and high residual stresses at the break ends is as follows: The arc is started a short distance from the lower edge of the repair, run to that edge, then with a wiping motion immediately reversed over the initial deposit. The bead is continued to the other end where the arc is extinguished by running it back up on the weld deposit.

A skip-weld technique is followed when welding on the inside of a mold. Extreme care should be exercised to prevent excessive contracting stresses by avoiding all heat color in the base metal during welding.

Light peening is recommended after each pass to relieve the contracting stresses set up by the solidification of the cooling weld deposit. A light weight hammer or a slag-chipping hammer with the pointed end ground off to the size of a pea may be used. Too heavy pounding will fracture the deposit or the adjacent base metal.

Slag should be chipped off after each pass. To gain maximum hardness in the repair, two passes may be applied so as to offset the dilution of the base and/or filler metal in the first pass.

After the weld repair has been completed, it is advisable to post-heat the work to the preheat temperature, especially with chromium-bearing steels. The mold should be cooled in still air to room temperature. Drafts should be avoided during welding and cooling of the mold.

If a hair-line or fatigue crack extending from the bottom of the weld deposit into the mold itself is not found until after the repair has been completed, this crack should be ground out and welded without disturbing the completed repair.

Figure 5 shows the female section of an air-hardening tool steel mold used to form phenolic insulator parts. This mold had developed severe cracks at points "A" and "B." These sections were thoroughly ground out to remove all sharp edges and any of the remaining

fatigued metal, after which EutecTrode 680 AC-DC was used to fill up most of the routed-out section. Two final passes of EutecTrode 6-HSS (AC-DC) brought the repaired surface of the mold back to its original working hardness.

Still another example of mold repair welding in the plastics industry is illustrated by Figure 6, which shows two parts of a mold. The broken part was annealed in a controlled-atmosphere furnace; all sharp edges were removed; and the broken section then built up with a 3/32-inch SteelTectic electrode. Upon completion of the build-up, the piece was machined to the required shape, carburized, and hardened. If required, the part also can be machined just a few thousandths of an inch oversize, just enough for a grinder to "clean up" without affecting the hardened case.

Continued usage of plastic molds eventually causes sharp edges to wash out or even break. Figure 7 shows such a matched mold set, in which the edges had worn and were rebuilt to original shape with EutecTrode 680 AC-DC. On similar applications where smaller size electrodes are required, EutecTrode 670 AC-DC has achieved consistently satisfactory results.

Another example of injection mold welding is illustrated in Figure 8. This particular mold set is used to mold plastic toy motorcycles, and continued usage had washed out many of the finer details. Rather than scrap the entire mold, it was found simpler and more economical to build up the worn areas with EutecTrode 680 AC-DC then tool and finish them to the required contours.

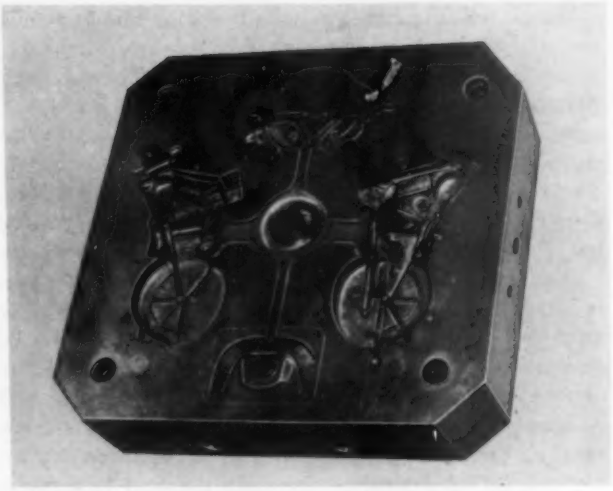


Fig. 8. Mold for toy plastic motorcycles after rebuilding of worn areas.

Cast Iron Molds

Some cast iron molds are used today. Practically all cast iron molds are alloyed in some way so as to achieve a finer grain structure and greater shock resistance. Mechanite is an example of this type, although there are still some straight gray iron molds in use. When a mold of this type breaks into two pieces, it is seldom economical to weld it unless it is small in size or replacement-and-waiting time poses a serious problem. No special equipment is necessary to repair these molds, other than an oxy-acetylene torch or arc welding equipment.

Figure 9 shows another interesting application of EutecRod 140FC in weld repair of cast iron. Actually, the three units shown are not molds, but are plungers used in the glass manufacturing industry. At "A," the top portion of the plunger which had worn severely, has been cut off; at "B," the plunger has been built up with EutecRod 140FC; and at "C," the build-up has been machined and polished. Absence of any line of demarcation or fusion-hardening, and a close match of metal color and physical properties make this another perfect application of EutecRod 140FC.

Mechanite is a special type of cast iron produced under processes which control the distribution of free carbon in the metal. Whereas many weldors consider this type of cast iron very difficult to weld-repair, it can often be overlayed with a "cushion" of Xyron* 2-25 (AC-DC), then finished with a hard layer of Eutec-

Fig. 9. Cast iron plungers during weld repair: A—Broken tip has been cut off; B—Plunger tip has been rebuilt by welding; and C—Rebuilt tip after machining and polishing.

Fig. 10. Box-forming mold after repair by oxy-acetylene welding.

*Product of Eutectic Welding Alloys Corp.

Trode 4.

In arc welding cast iron, the break or build-up must first be carefully prepared by chipping out all broken pieces and removing all sharp corners. The relatively porous mold surfaces become impregnated with various solutions. In addition, under continuous working the surface work-hardens, becomes brittle, and tends to chip. Therefore, when a section is to be built up, the surface should be ground off sufficiently to remove this fatigued metal and permit the deposition of at least three passes.

After grinding, the mold is preheated. Ideally, this is handled in a furnace. In so many cases, however, the mold is too large or conceivably the repair must be effected while the mold is still in the press, so that one or two oxy-acetylene torches are used. No effort should be spared to maintain a uniform preheat over a large area to minimize residual stresses brought on by an uneven rate of contraction between the cold base metal and the hot filler metal.

With EutecRods 140FC and 185FC (torch), preheats of 600-900° F. are found useful. When using Xyron 2-25 (AC-DC), preheating is not necessary, although a 300-400° F. preheat is utilized on some very sensitive applications. In addition, Xyron 2-25 (AC-DC) may be used for "cushion" purposes to eliminate the peeling effect sometimes encountered in cast iron welding.

Xyron 2-25 (AC-DC) is a special electrode designed for all cast iron welding which achieves penetration with a minimum transition temperature zone and without cracks. It is the only electrode recommended for this initial pass or "cushion" layer because it will not crack or cross-check. Such a cushion layer will take up the contraction of the following layer or overlay material, minimizing the effect of pulling or shrinking action and reducing weld stresses. In welding this cushion layer, weaving of the electrode is not recommended; only stringer passes should be used. Once the cushion layers have been deposited, the correct electrode for the final passes is then chosen in accordance with the hardness of the mold.

For welding purposes, cast iron molds can be grouped into three classifications, judged according to hardness rather than metallurgical analysis:

Class	Brinell Hardness
1	170
2	235
3	320

This hardness can be determined readily by means of an ordinary mill file. If there is considerably drag on the file, the cast iron is in Class 1. If the file still takes off a fine shaving but has the tendency to slide over the surface at times, the mold is in Class 2. If there is very little drag, the mold is in Class 3.

For molds having a hardness of Class 1, use Xyron 2-25 (AC-DC); for Class 2, use Xyron 2-25 (AC-DC) then face with EutecTrode 680 AC-DC; and for Class 3, use EutecTrode 4 (AC-DC). At times, only a certain section of a mold is subjected to greater wear. For this case, the use of electrodes for Classes 2 and 3 is recommended. Electrodes in these two classes will outwear cast iron.

Straight stringer beads, with no weaving, are recommended for the finished deposit. Do not continue welding if heat color shows in the base metal. Peening after each bead is desirable to relieve residual stresses. For peening, use a very small hammer or a weld-chipping hammer with a sharp point ground off to the size of a pea. Peen lightly but thoroughly for best results.

Beryllium Copper Molds

Due to its interesting characteristics, beryllium copper has found wide acceptance in molds for plastics. Often, however, the mold cavities develop scores and fine detail washes out. This condition may be repaired with an oxy-acetylene torch using EutecRod 1601, together with Eutector Flux 1601 B. This alloy has splendid affinity for beryllium copper, and its application temperature is considered ideal for precipitation hardening of the metal. EutecTrode 1851 DC (1850 AC) also has been used successfully.

In some cases, it may be desired to change the gating on a mold. It is preferred to not bring the mold to a high heat, and a softer material such as a solder would be ideal since it could be easily formed with hand tools. Solder, however, has too low a melting point and would enter the liquid condition when it became intimate with the plastic. EutecRod 155 has the advantages of solder, but has a remelt temperature of 640° F., may be used successfully for this type of work. This EutecRod is used with Eutector Flux 155.

Figure 10 illustrates the repair by the oxy-acetylene process of a mold used for forming a box. This mold has been rebuilt with EutecRod 185 FC, a tough, yet machinable overlay which is dense, will not peel, has high remelt temperature, and is applied at a black heat. After application, the mold was finished by machining.

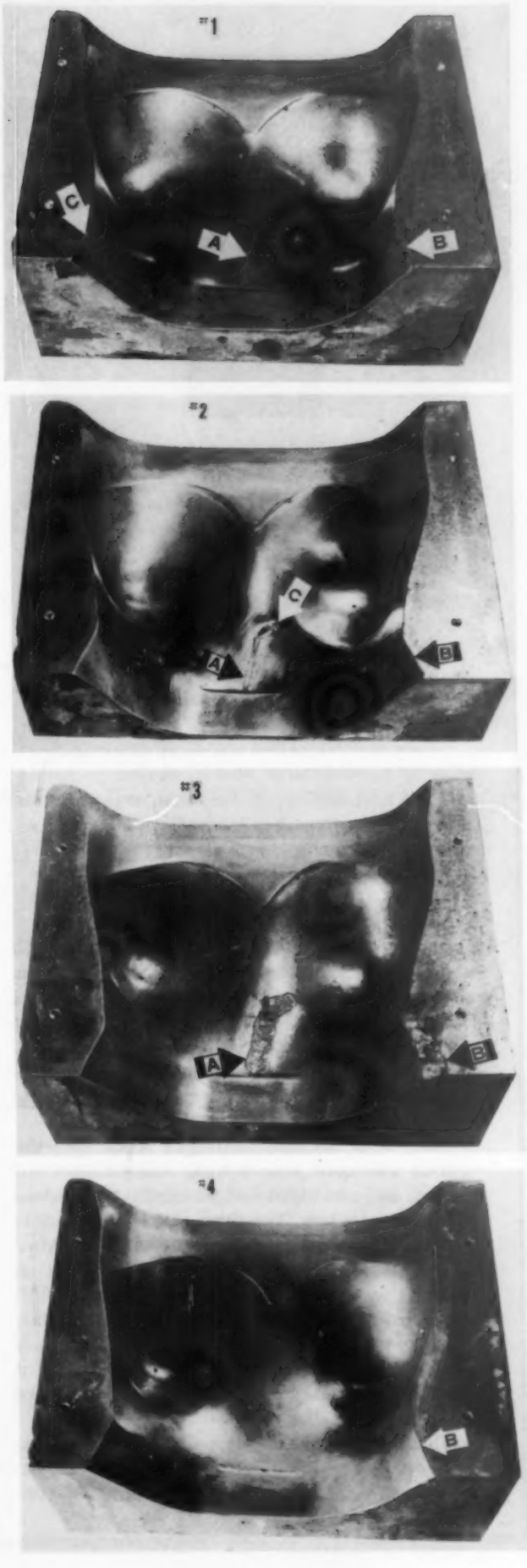
Kirksite Molds

Kirksite is frequently used as a form to set plastic under steam. Kirksite consists primarily of zinc, alloyed with small amounts of aluminum, copper, and other elements to give it toughness. The alloy has a low melting point of 800-900° F. and requires considerable preheat to bring it up to repair temperatures (400-500° F.). Depending on the casting's size, one or two oxy-acetylene torches are needed to affect a repair on this type of mold. Fortunately, damages are easily repaired if the proper procedure is followed.

To begin with, all damaged surfaces should be chipped, burred, or ground out, and all sharp corners eliminated. No more material than necessary should be removed to avoid waste of filler metal. After the weld area has been thus readied, it should be preheated to approximately 400-500° F. with a slight excess acetylene flame. Welding should be backhanded so that a clean, unoxidized surface will always be maintained ahead of the weld. EutecRod 196 should be fed into the flame drop by drop and flowed out along the weld area. This EutecRod should be used with Eutector Flux 196.

If more than one pass is necessary to fill the gouged area, each pass should be "deoxidized" before the

Fig. 11. Weld repair of a Kirksite mold. #1. Worn mold prior to welding. #2. Worn mold after grinding out cracks and cleaning. #3. Worn mold after welding. #4. Finished mold after weld repair.



succeeding layer is deposited. To do this, the pass is heated to the "mushy" stage and the surface oxides (scum) cleaned off wth a small spatula. Only a small area should be heated at a time until the entire deposit has been thus deoxidized.

When the repair has been completed, allow the mold to cool to room temperature and file or machine to the desired finished surface. No subsequent heat-treatment is required with this type of mold material.

The four "step-by-step" photographs of Figure 11 illustrate the reclamation of a Kirksite mold, and shed some light on a phase of welding about which little information is currently available. Photo #1 shows the mold as it came into the shop to be repaired. The need for welding was two-fold: a hairline crack had developed at "A"; and "B," one of the forming edges, had worn severely, and needed building up. This edge can be compared with the sharp, crisp edge, "C," at the other end. The small hole from which the crack had originated is a water injection hole, of which six more are spaced throughout the mold.

The crack, "A," was ground out and the surrounding area was cleaned to remove any oil, grease, or surface oxides. A small hole was then drilled at the end of the crack, "C," to prevent it from spreading any further. Area "B" needed only a cleaning with emergy cloth. All these steps are visible in Photo #2.

The mold was next preheated to approximately 500° F. Using a slight excess-acetylene flame, EutecRod 196 and Eutector Flux 196, the weldor started at "A" in Photo #3 and welded backhand toward the water injection hole. To simplify deposition of the second pass, the surface oxides that had formed were removed. In welding the worn surface, "B," the procedure was identical, except that here it was important to hold the torch perpendicular to the direction of travel so as to keep complete control of the weld puddle and avoid having it spill over the edge. Of course, flux residues must be removed carefully when the job is completed.

The result of a carefully planned and executed job can be seen in Photo #4, showing the mold ready to return to work. Not a trace of the weld is visible, and there is no sign of porosity or cracking. In fact, the knife edge at "B" is almost better than it had been originally.

Conclusions

These are but a few case histories of how the diligent usage of Eutectic "Low Temperature Welding Rods" are saving substantial sums for companies in the plastics industry. Actually, there are hundreds of other applications; in fact, the industry is expanding so rapidly that many new applications will have come to light by the time this article is published. —The End

Guest Editorial

Plastics from the End-User Standpoint

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Plastics Division, Monsanto Chemical Co.
Springfield, Mass.

MOST READERS of PLASTICS TECHNOLOGY will recall the famous story of the blind men and the elephant. As I remember it, four men who could not see encountered the great beast for the first time. Each touched a different portion of the elephant's anatomy and from this limited experience tried to induce the nature of the whole animal.

One, who felt the elephant's side, said the animal was quite like a wall. Another touched the leg, and concluded that an elephant resembled the trunk of a tree. The third clutched the trunk, and compared the beast to a stout rope. After grasping the tail, the fourth man insisted that an elephant was similar to a snake. Whether a fifth man was there to feel the animal's smooth tusks, I cannot recall. But it really doesn't matter, since I have repeated this old story merely because it can help illustrate a point which I should like to make.

The point is this: most of us are guilty of the same faulty reasoning pattern. From singular experience, we leap too often to unwarranted conclusions about the whole. I suppose it is a part of being human. Think back, for example, to those days not so long ago when plastics products first began to reach the consumer market in significant volume. We saw this same faulty reasoning phenomenon exhibited then and, even today, our industry is still feeling its effects.

It was during the war years when plastics were still relatively new and the public still relatively unfamiliar with them. In fact, few of those who were closest to these new materials recognized their vast potential then. I am not certain that this potential is generally recognized even today. The typical consumer was encountering plastics for the first time and, like the blind men of the story, was making hasty judgments of our industy on the basis of his initial contacts with a few products which he assumed were representative of our best. Sometimes they were our best; unfortunately, however, in many cases they were not.

In some areas of the plastics industry, a zeal to market new products developed faster than a sense of proprieties. Misapplications too frequently

resulted and unwary consumers, who somehow had gotten an impression that plastics could do no wrong, quickly were disillusioned. Men who saw styrene razors soften and deform in hot rinse water said plastics were "no good." Women whose flimsy vinyl rainwear tore apart at the first wearing decided that they "hated" plastics. Children whose ill-designed plastic toys snapped in two after only a few minutes of play cried loudly.

Time and again we observed how just one poorly executed application of our materials could offset dozens of sound uses. Like blind men grasping the tails of unfamiliar elephants, too many buyers were finding "conclusive" evidence that plastics were snake-like. And a strong distrust of snakes is almost universal. Stigmata such as these are easier come by than eliminated. For more than a decade, the plastics industry, at first sporadically and then unrelentingly, has tried to overcome these unfortunate early impressions. Moreover, we have been at least moderately successful. The fact that a great measure of consumer faith in the plastics industry has been restored is testimony to the fact that misapplications are rarely encountered today.

Conscientious enforcement of self-imposed rules has helped our industry's cause more than any other single factor. In some areas, for example, the industry has established minimum standards of manufacture and/or use. Vinyl film and styrene wall tile are notable examples. We also have adopted an ambitious, but completely workable, "Statement of Principles" to guide our day-to-day operations. And by spoken and printed words we have spread the story of plastics to our many publics.

In short, the road to maturity also is bringing the industry to a general awareness of its responsibilities to the consumers of its products, and an eagerness to accept those responsibilities. These are all healthy signs which I interpret as a reflection of sincere and determined effort to earn universal public acceptance for ourselves and our products. The job is not done, and we can never allow ourselves to become complacent if the prestige of our industry is to keep increasing.

We must continue to conduct our business in accordance with, and in the spirit of the "Statement of Principles" which we have committed ourselves to uphold. Adopted more than two years ago, that Statement provided an excellent framework within which we can steadily bolster our industrial position. Superficially, at least, our "Statement of Principles" has taken hold. Copies of it have been widely circulated throughout the industry; signatures have been affixed to it to denote individual and corporate acceptances; tastefully framed, it has been hung in executive offices; and unframed, it has been tacked to plant bulletin boards. It has received oral and editorial plaudits everywhere. To what extent the principles have become a part of the industry's business philosophy is difficult to measure, but surely inroads are being made. Just getting them down on paper has been an important stimulant to our thinking.

Although it is helpful to have this "golden rule" as a guide, we also must formulate specific programs in order to accomplish the stated objective that plastic materials "will bring to industry and public alike all the benefits, economies and satisfactions inherent in these versatile engineering and construction materials." Some of the specific programs which have been proposed merit special emphasis.

Firstly, our vigilance to guard against misapplications must not slacken. We must be thoroughly familiar with the physical and chemical properties of the materials we use. We must continue to refine and improve our testing methods to make certain that every one of our products is properly evaluated before it reaches the market. This is especially significant now that plastics are finding their way in many cases into the structural building materials field where satisfactory performance over a long period of years is a fundamental requirement.

Additional minimum standards of manufacture and performance should be established in all applicable areas. Such standards will help us deliver to the public products of consistent high quality.

Informative labeling of plastic products should be nurtured until it becomes the rule rather than the exception it is today. Consumers of our products should learn to look for labels that impart helpful information; moreover, they have a right to expect them.

A recent survey of department store buyers and merchandise managers, conducted by "Department Store Economist," showed that 92% of those replying believed they needed more information on plastic products. Specifically, they wanted to know how to care for them, their performance expectations, what not to do to them, how they compare with other materials, in similar products, and what types of plastics are used in consumer products. If our customers feel that way, how must our customers' customers feel? The need for a vigorous informative labeling program is, I think, quite obvious.

By the same token, an even broader program of customer and consumer education is indicated. Through our trade organizations, notably The Society of the Plastics Industry, we have made a good start. When the housewife begins asking for polyethylene rather than simply for "the plastic you can squeeze"—and I know this is happening

(*Continued on page 747*)

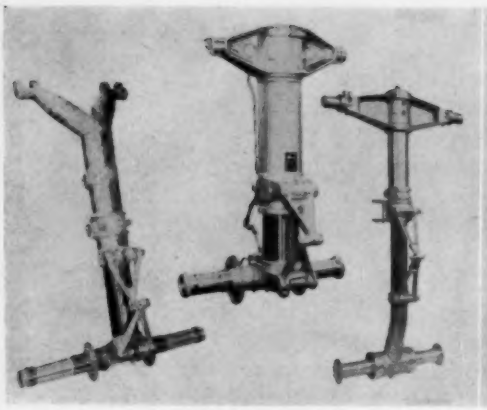

Fig. 1

Fig. 2

Fig. 1. Aerol shock-absorbing units for aircraft landing gears.

Fig. 2. Cross-sectional view of Aerol landing strut for aircraft. In operation, the wheel mounted on axle (A) contacts the ground, and the upward thrust telescopes the piston (G) into cylinder (H), causing the oil in chamber (F) to be forced through the orifice (I) around the metering pin (J), thus creating a hydraulic resistance in chamber (F). This resistance, being controlled by the shape of metering pin dissipates the energy. Flow of fluid through the orifice into chamber (E) compresses the air, creating further resistance to the telescoping action. Expansion of the compressed air is controlled by a return valve, eliminating excessive recoil to the piston.

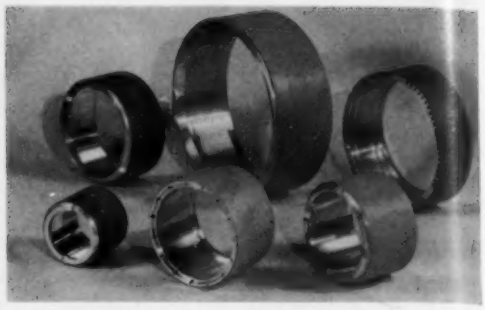

Fig. 3. Piston sizes for Aerol landing gears range from 3-10 inches.

Fig. 4 Cured laminate-clad aluminum tubing is turned to exact outside diameter required.

Plastic-Clad Metal in Hydraulic Pistons

A covering of phenolic laminate bonded to a base of 24ST4 aluminum is used in a lightweight piston design by Cleveland Pneumatic Tool Co., Cleveland, O., for its Aerol shock-absorbing struts that are used in the landing gears of commercial and military planes. The plastic-clad metal was developed by Synthane Corp., Oaks, Pa.

In the Aerol units (see Figure 1), the pistons regulate the use of air and oil to cushion the landing impact of a plane. The principle of the shock strut is shown in Figure 2. As the landing gear contacts the ground, the upward thrust upon the wheels causes the piston section to telescope, forcing oil through a small orifice and compressing the air in a chamber above. As the piston rises, a tapered metering pin mounted on the piston head enters the orifice, restricting the size of the opening and the subsequent flow of oil. This design principle dissipates the tremendous amount of kinetic energy generated at each landing.

The pistons used in these units must be mechanically strong, shock resistant, impervious to oils, and resistant to sharp temperature changes. Metal-to-metal contact between piston and cylinder must be avoided to prevent the piston from seizing inside the cylinder due to the effects of weather or hydraulic oil on the metals.

The new pistons have specified thicknesses of phenolic laminate permanently bonded to aluminum core tubes of various diameters. A series of precise machining operations converts the plastic-clad tubing to piston head bearings (see Figure 3).

Synthane begins production of the piston heads by knurling a 38-inch long aluminum tube for its entire length to produce the roughened surface which anchors the bonded laminate covering. The covering is a continuous length of specially-treated fine-weave cotton fabric thoroughly impregnated with a phenolic resin. As the fabric passes over heated pressure rollers to be wrapped around the aluminum tube, the resin softens and polymerization takes place, thus fusing the layers.

Sufficient layers are wrapped around the tube to obtain a wall thickness that is slightly above requirements, after which the tube is oven-cured to complete the polymerization. The laminate wrapper then is machined to the proper outside dimensions (see Figure 4), after which the tube is cut to the specified lengths. Synthane then performs more than a dozen finish-machining operations to produce each piston head.

(*Continued on page 746*)

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and

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Estimating Concentrations of Amine Curatives for Epoxy Resins

A mathematical method for quickly estimating optimum proportions of primary and secondary amine curatives for specific epoxy resins.

NITROGEN-containing materials, especially amines, are widely employed in the curing of epoxy resins used in numerous applications, such as adhesives, coatings, encapsulations, foams, and fabric-reinforced plastic laminates. A method is described in this paper for mathematically estimating the optimum amounts of amine-type curing agents for epoxy resins.

This method may be employed for curatives of the primary amine type, but not for tertiary amine curatives. Curatives containing secondary amine groups may also be employed here, particularly if the curative also contains an equal or greater number of primary amine groups. Diethylenetriamine (H_2N-CH_2-Ch_2-NH-CH_2-CH_2-NH_2) and phenylenediamine (N_2N-C_6H_5-NH_2) are typical examples of commonly employed amine-type epoxy resin curatives for which this method is applicable.

This mathematical method is a first approximation, and is dependent upon various assumptions. Accordingly, it is of practical value in quickly orienting the researcher who must establish the optimum concentration of curative for a given epoxy-base resinous material. Once the approximate resin-curative proportions have been calculated, the research worker should experiment over a range of concentrations in the vicinity of his estimate, employing as his criteria whatever physical and/or mechanical properties are of greatest interest to him.

Basic Equation

The basic equation to be employed in calculating the proper proportions of amine and epoxy resin is:

$$x = \frac{\text{Epoxide Value}}{\text{Amine-H Value}} \cdot 100 \qquad (I)$$

where x is the amount of amine-type curing agent to be employed, in parts* per 100 parts of epoxy resin (phr); epoxide value is the number of epoxy equivalents per 100 grams of resin; and the amine-H value is defined as the number of hydrogen equivalents attached to nitrogens (in the molecular structural formula) per 100 grams of amine curing agent.

The epoxide values for various epoxy resins may be obtained from the resin manufacturers or, if necessary, they can be determined by chemical means. The amine-H value is calculated from the following relationship:

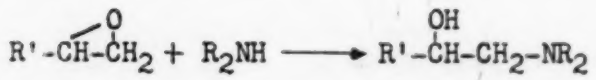
$$\text{Amine-H Value} = \frac{\text{No. of active hydrogens per molecule}}{\text{Molecular Weight}} \cdot 100 \qquad \text{(II)}$$

In this relationship, the hydrogen atoms referred to are those attached to nitrogens, and the molecular weight is that of the amine curing agent.

Inert fillers (e.g., aluminum dust, powdered aluminum oxide, silica, titanium dioxide, milled glass fibers, powdered mica, etc.) and other non-reactive additives may be regarded as diluents of the epoxy resin. Thus, a resinous material consisting of 100 parts epoxy resin plus 50 parts inert filler would have an epoxide value of two-thirds that of the "undiluted" (unfilled) resin.

Derivation of Basic Equation

It is assumed that primary and secondary amine curing agents react with epoxy resins by the following mechanisms:



According to these mechanisms, the secondary-amine product of the first addition-type reaction can react further in accordance with the second reaction. Thus, all hydrogen atoms attached to nitrogen atoms are considered to be active (e.g., consumed during the course of curing) provided, of course, that sufficient epoxy groups are available.

No allowances are made for the ionic catalytic mechanism** believed to occur with tertiary amines. It is assumed that once the primary and/or secondary amine has reacted with the epoxy group or groups, the catalytic activity of the nitrogen becomes sterically hindered to a point where its effect is of minor significance. It is quite possible that both mechanisms (addition reaction and catalysis) can occur simultaneously. With primary amines, however, the catalytic mechanism is believed to be of significantly less importance.

The stoichiometry of the curing reaction mechanism postulated required that in a given resin-curative mixture,

$$\text{No. of epoxy groups} = \text{No. of active hydrogen atoms} \qquad \text{(III)}$$

For y grams of epoxy resins,

$$\text{No. of epoxy group} = \frac{N_o \cdot (\text{Epoxide Value}) \cdot y}{100} \qquad \text{(IV)}$$

and for x grams of amine curing agent,

$$\text{No. of active hydrogen atoms} = \frac{N_o \cdot (\text{Amine-H Value}) \cdot x}{100} \qquad \text{(V)}$$

In both (IV) and (V), N_o is Avogadro's number (6×10^{23} molecules per gram of molecular weight).

Substituting (IV) and (V) into equation (III), we obtain

$$\frac{N_o\ (\text{Epoxide Value}) \cdot y}{100} = \frac{N_o \cdot (\text{Amine-H Value}) \cdot x}{100} \qquad \text{(VI)}$$

If y is 100 parts (grams) of resin, this reduces to equation (I)

Typical Calculations

The first example deals with the calculation of the optimum amount, in phr, of diethylenetramine (DTA) to be employed in curing Epon 828 resin. According to the manufacturer, Shell Chemical Corp., Epon 828 has an epoxide value of 0.52. DTA has five active amine hydrogens, and its molecular weight is 103. From equations (II), it can be calculated that DTA has an amine-H value of 4.85. Then, using the basic equation (I),

$$x = \frac{0.52}{4.85} \cdot 100 = 10.7 \text{ phr}$$

This proportion corresponds with the value of 10 phr found by actual experience to be optimum. For example, 10 phr resulted in a casting which developed a Barcol hardness of approximately 40 within two hours at 135° F., while 70 hours at 135° F. were required to reach the same degree of cure with five phr. Presumably, the ionic catalytic mechanism accounts for the continuing cure with five phr. Such a long curing cycle, of course, is generally extremely undesirable.

A second example is the calculation of amount of Curing Agent CL (also made by Shell Chemical Corp.) to use in curing Epon 828. This curing agent, metaphenylenediamine) has an amine-H value of 3.6, as calculated from equation (II). Then, using the basic equation (I), we arrive at a proportion of 14.4 phr. This corresponds with the 14.5 phr value given by the manufacture

—The End

* All parts are by weight.

** The tertiary amine group (R_3N) acts as a true catalyst, inducing reactions between neighboring epoxy and hydroxyl groups without being itself consumed in the reaction.

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Spread Coating Techniques—Part I

The beginning of a two-part review of current methods of spread coating by means of knife coating, roller coating, impregnating, transfer coating, and lamination.

THE coating industry, although originated by the ancient Egyptians in applying decorative designs and protective materials to mummy shrouds, grew up in an environ of unsystematic development during the first half of the nineteenth century. The early rubber compounds were frequently dissolved in turpentine and coated with machinery, such as patented in 1835 by E. M. Chaffee of Roxbury, Mass., that is still basically unchanged. Most of the current volume of coated fabrics is made on the same type of equipment used during this period of development.

Coating compounds have advanced in seven-league boots, but the application technique lags far behind. The whole story of the development of the variations in coating equipment is an interesting one, but this paper is limited to a brief discussion of present-day equipment.

The coated materials considered in this study include such common products as upholstery, vinyl luggage, book binding, tent and awning materials, raincoats and garments; and such products as audio and video recording tape, magazine paper stock, abrasive cloth and paper, pressure-sensitive tape, homogenized tobacco sheet, waxed paper, carbon paper, metallic yarns for woven textiles, moisture-proof and heat-sealing cellophane, playing cards, laminated plastic sheets, ceiling panels, cotton rug back coating, non-woven webs, plaster of paris bandages, milium metallic-type coating on clothing and draperies, and coated fiberglass for rocket construction.

For the purpose of this discussion, the definition of "Spread Coating" has been liberalized to permit inclusion of the several processes of laminating. In order to condense this project as much as possible, the following classifications are made: (1) knife coating; (2) roller coating; (3) impregnating; (4) transfer coating; and lamination.

The processes of brush coating and spray coating are not widely used in the coated sheet industry, and are not included in this discussion. Drying or fusing equipment is an inseparable adjunct to most spread-coating processes. Excepting the economic aspects of initial costs and operating expense, the selection of gas-fired, oil-fired, steam-heated, or electrically-heated drying and fusing equipment is academic and is not included in this paper.

Based on a paper presented at the twelfth annual National Technical Conference, Society of Plastics Engineers, Inc., Cleveland, O., Jan. 19, 1956.

Knife Coating

Knife coating is the most common method for the application of spread coatings to continuous webs such as paper, fabric, and films. Until the development of vinyl plastic coatings during the past 15 years, all pyroxylin and oil-coated artificial leathers and many rubberized fabrics were produced by knife coating equipment.

Control of the coating application depended on such unmeasured factors as web tension and knife setting, with the result that a coating machine operator was, and still is, a skilled artist. The other variable factors such as web speed, knife contour, and coating compound viscosity have been reduced to quantative standards.

Knife coating can be divided into five types: floating knife, knife-over-blanket, knife-over-roll, wire-wound coating blade, and rotating coating bar.

FLOATING KNIFE. In floating knife coating (see Figure 1), the web is drawn under the coating knife and the coating is applied from the "bank" in front of the knife. The various knife edge contours commonly used for knife coating range from the very sharp (0.010-inch) design to a rounded bar (about two inches in diameter). The back or leaving edge of the coating knife should be very sharp to minimize tendency to form coating blobs and scratches.

A general-purpose knife coating section uses a series of two or three knives for either alternate or tandem operation. Two coating knives in tandem are frequently used to obtain better surface smoothness of the coating.

KNIFE-OVER-BLANKET. The knife-over-blanket design of knife coating section (see Figure 2) is employed where the use of tension on the web is undesirable.

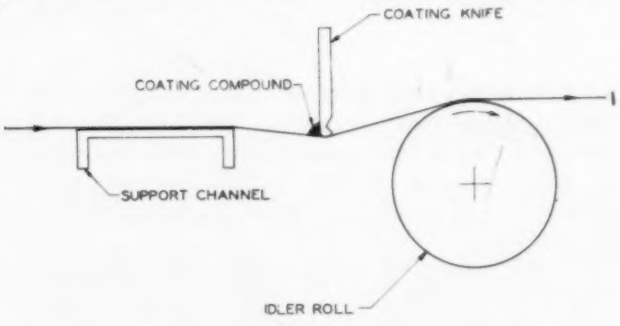

Fig. 1. Floating knife coating operation.

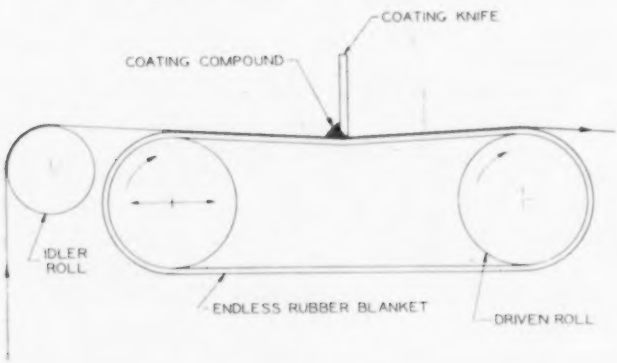

Fig. 2. Continuous knife-over-blanket coating operation.

The rubber blanket permits uniformity of tension against the coating knife that cannot be duplicated on an unsupported web.

KNIFE-OVER-ROLL. The knife-over-roll arrangement (see Figure 3) is generally indicated when the coating composition is of high viscosity, or where a heavy thickness of coating weight is to be applied.

Knife-over-rubber roll pressure coating usually employs a knife contour that is rounded on the entering edge so that the coating squeezes through the knife setting on the web by hydraulic action. It is not practical to attempt to grind a rubber backing roll to sufficiently accurate concentricity to permit its use by fixed clearance on light-weight coatings with good accuracy.

Knife-over-precision iron roll fixed clearance coating uses a precision-ground chilled iron roll used under an adjustable doctor blade to provide an accurate fixed coating gap. In order to insure proper "fit" of the knife edge to the roll surface, adjustable warping screws are mounted on the blade to compensate for effect of wear. In this arrangement, any variation in web thickness is reflected in the coated film at that point.

WIRE-WOUND COATING BLADE. The wire-wound doctor bar is used for low-viscosity coatings applied to smooth surfaces such as film and paper. Control of the coating weight depends on the diameter of wire wound spirally around the bar. In some applications, the bar is rotated by a positive drive to prevent the coating from drying on the "leaving" contour. For successful operation, the coated surface must flow together or level out before drying.

ROTATING COATING BAR. The rotating coating bar is usually employed as an accessory in a coating operation to remove pattern in the coated surface. The function of this unit is to pick up the coating at the entering nip and to re-deposit it at the leaving nip. By operation at various rates of revolution, the proper setting can be found to obtain optimum surface smoothness.

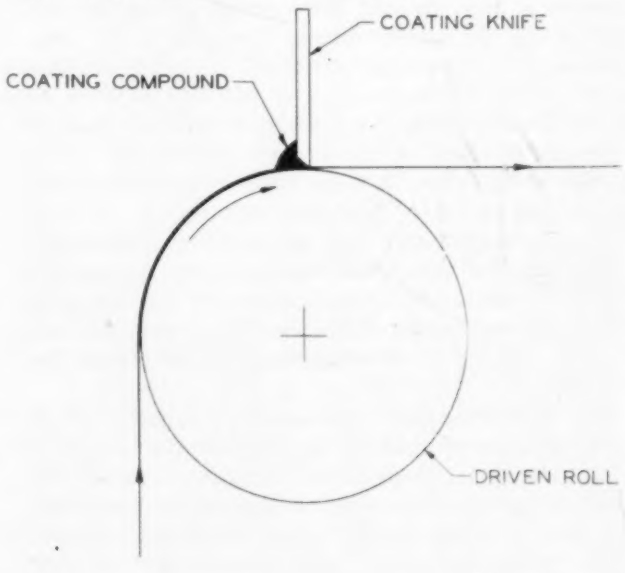

Fig. 3. Knife-over-roll coating operation.

No explanation of coating knives would be complete without reference to the function of coating knife dams. The need for edge dams to control the width of the coating bank is obvious. However, proper use of a backing plate to control the length of the coating dam is frequently unknown. By controlling the length of the coating bank, the degree of penetration of the coating into a woven web can be controlled. By the same adjustment, a fine control of coating weight also can be obtained. The use of a backing plate also insures a uniform bank length from edge to edge and, consequently, more uniform control of coating weight from edge to edge.

Roller Coating

Applications of roller coating equipment in the film and coated fabric industry have been borrowed directly from paper coating techniques. The development of vinyl paste resin coating formulations has stimulated the great interest in roller coating equipment for plastics. The technique includes the "kiss," pressure, reverse roll, and engraved roll coating methods.

"Kiss" Coating. The "kiss" coating process (see Figure 4) applies coating to a web surface by press contact with a metered amount of coating on a roll surface. At this point, the film of coating is split; part remaining on the roll, and part adhering to the web surface. Some method of smoothing the wet coated web surface is usualy desirable to eliminate the pattern that is formed.

In the roll control of kiss coating thickness, adjustment is made of the clearance between the roll surfaces. Bar or knife control of kiss coating thickness substitutes a fixed surface adjustably located with reference to the coating roll. Control of coating weight is satisfactory with this latter arrangement, but there is a hazard of the formation of scratches in the coating at the metering edge.

Pressure Coating. The pressure coating process meters the coating as it is applied to the web surface, so that any variation in web thickness is reflected in a coating variation. By the use of two steel rolls in a pressure coating arrangement to provide a fixed clearance control (see Figure 5), a precise thickness meter can be obtained. This arrangement is desirable for heavier coatings.

For light-weight pressure coating, a squeeze between a rubber roll and a steel roll is preferred. At the close setting required for a thin film of surface coating, small variations in thickness of the web are absorbed by the rubber cushion roll covering.

Reverse Roll. Basically, the reverse roll coating process accurately meters the coating thickness on a roll surface, and then transfers all of the metered coating to the web. The transfer is made at a controllable surface speed ratio to eliminate any coated pattern effect.

With the total thickness meter type of reverse roll coating (see Figure 6), the transfer and doctor rolls are accurately ground chilled iron rolls mounted in precision bearings and provided with very accurate means for controlling roll spacing. The amount of coating to be applied to the web is measured by the roll spacing, and also by the speed of the transfer roll in relation to the web

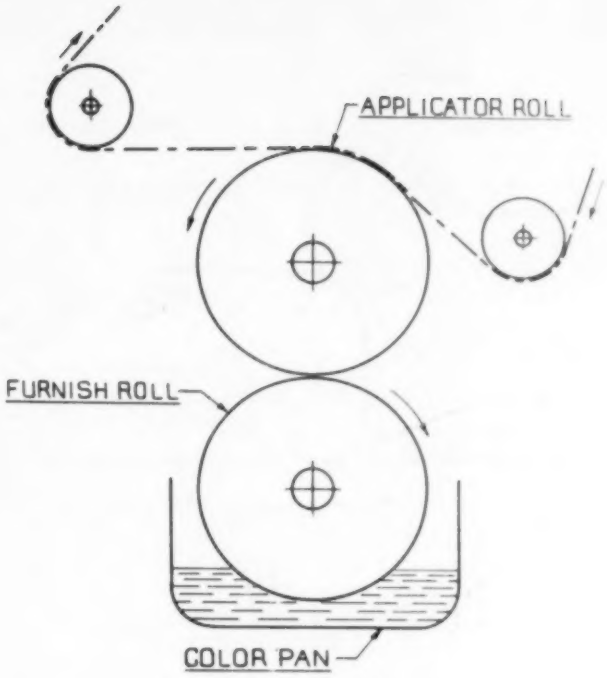

Fig. 4. "Kiss" roll coating process.

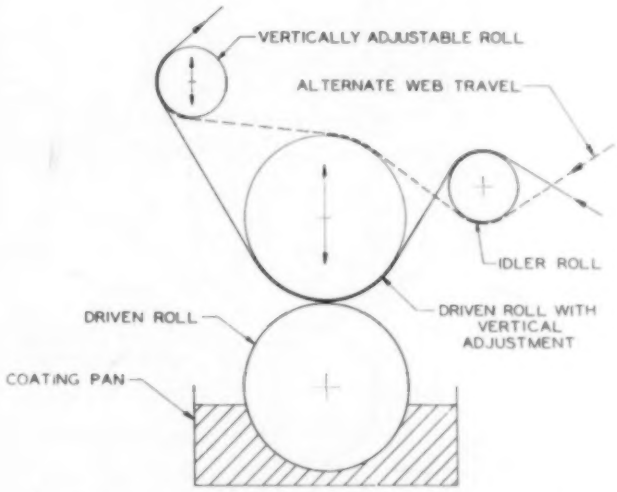

Fig. 5. Pressure roll coating with clearance control.

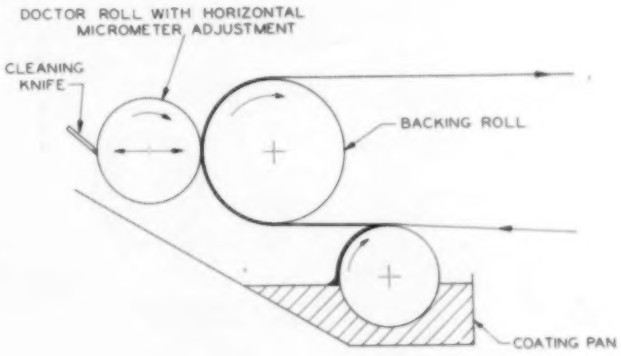

Fig. 6. Reverse roll coating process.

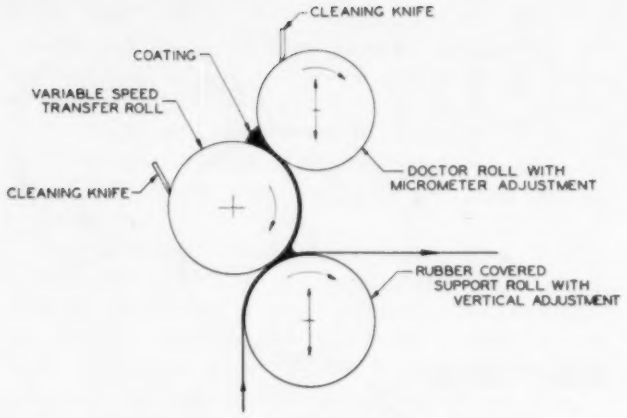

Fig. 7. Reverse roll coating with coating thickness control.

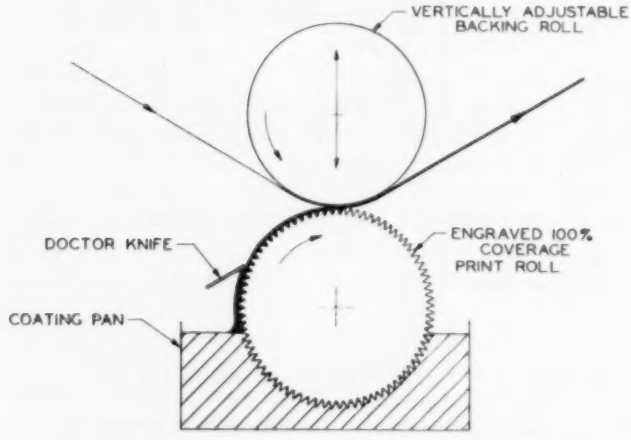

Fig. 8. Direct roll coating with an engraved roll.

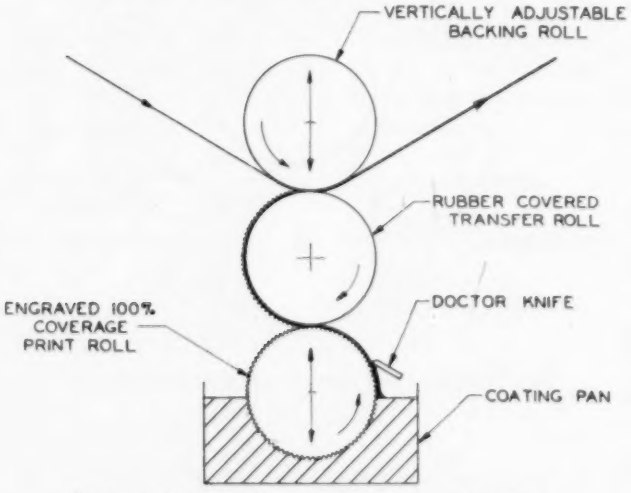

Fig. 9. Offset-type (Synchroset print) roll coating.

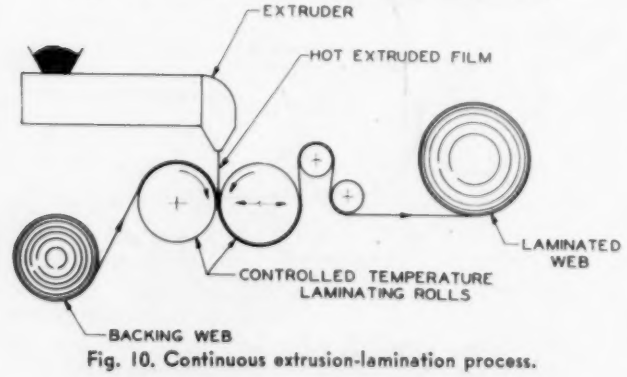

Fig. 10. Continuous extrusion-lamination process.

speed.

The coating thickness meter type of reverse roll coater (see Figure 7) has a different principle of operation from the process previously described. The web with excess coating passes through a fixed clearance between two precision rolls, and excess coating is removed by a wiping action. With this method, the weight or thickness of coating is dependent on uniformity of web thickness.

Engraved Roll (Roto-Gravure). Very accurate control of light coating weights can be obtained by use of an engraved coating roll. The design of the engraving pattern and the depth of engraving control the coated film thickness. Requirements for various web coating weights necessitate the use of several rolls with suitable engravinging. A heavy weight coating cannot be applied by engraving roll technique.

The process for direct coating with an engraved roll (see Figure 8) requires only that the web be pressed against the metered coating in the engraved roll surface. With coatings having poor flow characteristics, a pattern of the engraving may be formed on the web.

To overcome the hazard of pattern in the coated surface, a rubber transfer roll is used to convey the metered coating from the engraved roll to the web. The flat squeeze contact of the rubber roll surface obliterates any engraved pattern effect. This offset type of engraved roll coating is shown in Figure 9.

Impregnating

When the coating applied to a porous web is required to be within the openings in the web, there are three commonly used processes: dip and squeeze, dip and scrape, and vacuum or suction.

In the dip and squeeze process, the coating is actually forced into the web by the action of the nip of a pair of metering rolls.

When it is desirable to impregnate a web and, also, to deposit a substantial amount of coating on the surface, a dip and scrape arrangement is preferred. The scraping doctor blades vary in construction depending on the nature of the materials being handled.

When impregnation is required on open-type, nonwoven webs, it is usually preferable to remove excess pregnant by vacuum or suction while the web is supported on a chain-type conveyor. This method of handling avoids disturbance of the fiber which may occur in a squeeze process.

Transfer Coating

Transfer coating involves the application of a metered amount of coating to a carrier web such as a stainless steel belt. The backing material, such as a knit fabric, is brought into contact with the cast coating. After passage through a drying and fusing zone, followed by cooling, the combined fabric and coating is stripped from the belt which travels endlessly through the process.

The cast coating process permits the production of a smoothly coated surface with minimum coating weight, even though the backing web weave may be as open as a cheesecloth. It also permits the coating to be fused without strains, and eliminates the need for incorporation of

a releasing agent in the compound. The stainless steel belt can be heated electronically, but this equipment is quite expensive. By the use of high temperature, direct gas-fired air on the back of the belt, it can be brought to the fusing temperature (375° F.) in 15 seconds. A 25-foot oven length, therefore, will permit a production speed of 10 feet per minute.

The preferred method of application of coating to the web is by use of a reverse roll coating head with elastomeric transfer roll. By the transfer coating process, 100% plastisol coatings of any desired weight can be applied.

Lamination

Laminating can be performed by three methods; extrusion-lamination, wet lamination, and dry or thermoplastic lamination.

EXTRUSION-LAMINATION. Some thermoplastic resins, such as polyethylene and nylon, permit formation of flat sheets or films by molten extrusion from flat dies. In the extrusion-lamination process (see Figure 10), the hot extruded sheet is brought into contact with a suitable backing web under pressure of nip and cooling rolls. This is a refinement of the hot-melt coating process.

WET LAMINATION. This process (see Figure 11) involves the application of a suitable adhesive, usually to the plastic sheet, followed by contact with the backing web at the laminating rolls. The solvent in the adhesive may then be removed by passage through heating equipment. A variation of this process uses plastisol as the adhesive, and requires a fusing temperature to complete the lamination.

DRY LAMINATION. In the dry or thermoplastic lamination process (see Figure 12), the plastic sheet is combined under heat and pressure to a backing web. In order to obtain sufficient adhesion or bond, it is frequently desirable to apply a thermoplastic resin coating to either the plastic sheet or the backing web or to both prior to lamination.

To heat, the webs to the laminating temperature, they may be passed under radiant heating elements, through a heated air oven, or around heated rollers. All of these methods require the plastic sheet and the backing web to be heated separately and, usually, a differential strain is set up in the two laminated plies. This situation has been overcome by passing both webs around a heated drum before entering the embossing or laminating nip (see Figure 13). The process may be further extended to handle three plies of laminate simultaneously. There are modifications of this process which use an endless steel blanket to tightly press the materials in process against the heating drum.

So far in this discussion, we have described the arrangement for a suggested complete unit for transfer coating, and a suggested complete unit for lamination. A suggested complete line for spread coating (see Figure 14) would employ and unroll station for continuous operation, a knife coating head, a three-zone drying and fusing oven, a smoothing or embossing unit, cooling rolls, and a constant-tension rewind. For some products, a re-

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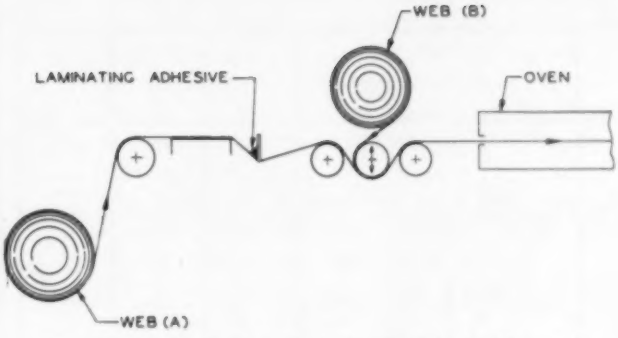


Fig. 11. Wet lamination of plastic sheet to backing web.

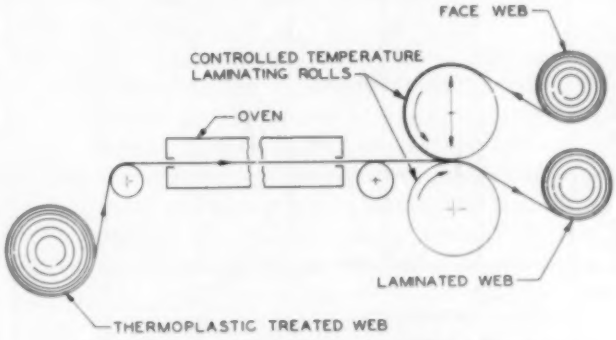


Fig. 12. Dry or thermoplastic lamination process.

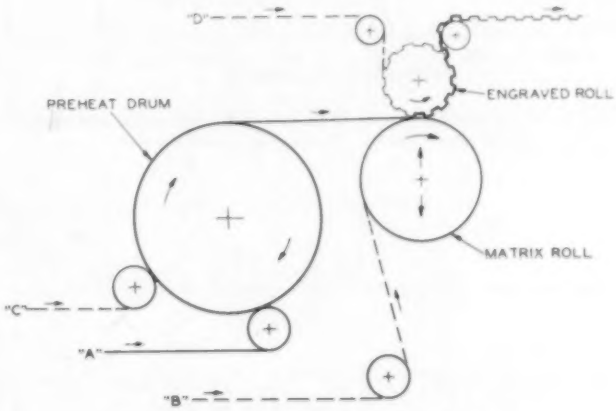


Fig. 13. Drum preheated embossing laminator.

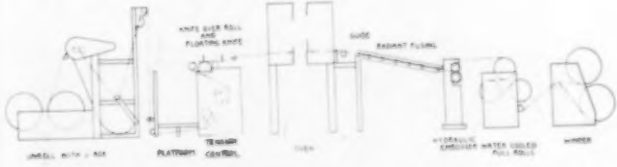


Fig. 14. Suggested complete line for spread coating.

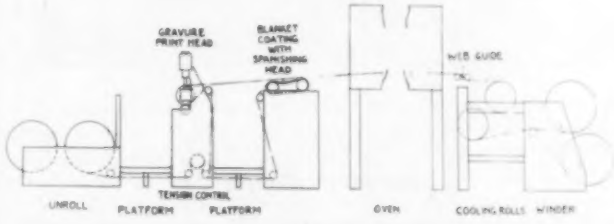


Fig. 15. Suggested companion line for finishing of coating.

Effects of Fillers in Polyethylene
(*Continued from page 729*)

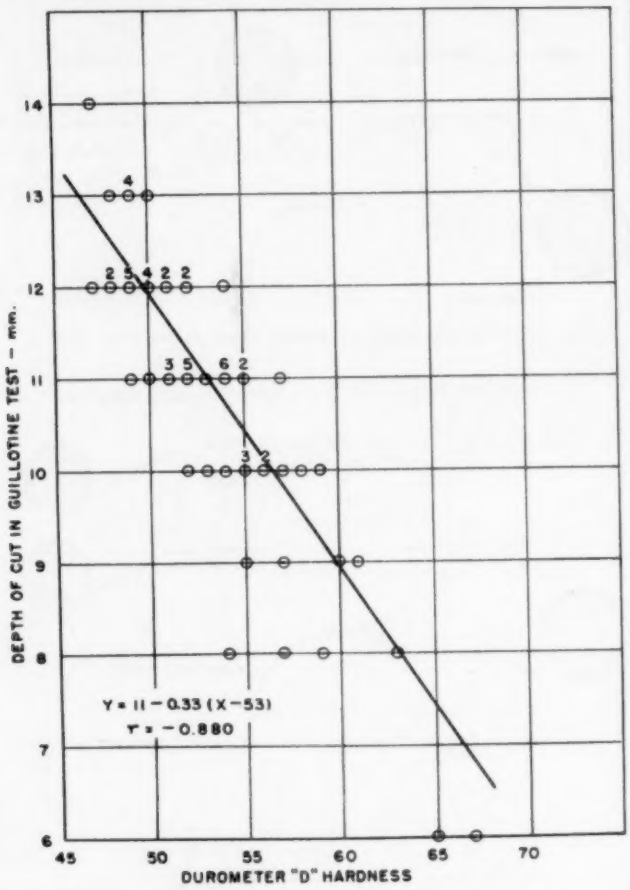


Fig. 3. Correlation between Durometer "D" hardness and secant modulus at 23° C.

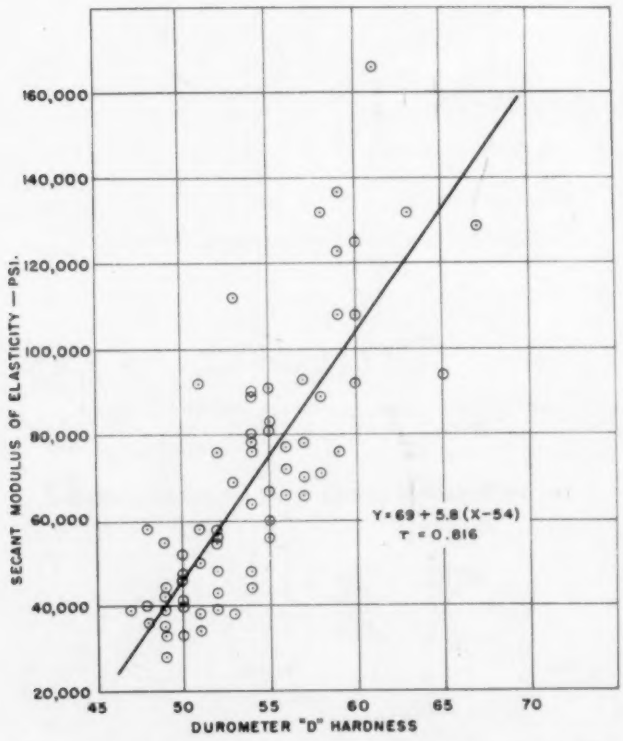


Fig. 4. Correlation betweel Durometer "D" hardness and depth of cut in guillotine test.

80° is plotted against heat distortion at 66 psi. This is the weakest of the group with a correlation coefficient of only 0.46.

Figure 3 is a plot of Durometer "D" hardness against secant modulus at 23° C. A correlation coefficient of 0.82 shows this to be a fairly good correlation. In Figure 4, Durometer "D" hardness is plotted against depth of cut in the guillotine test. This is the best correlation of the group with a coefficient of –0.88.

As a result of these correlations, several tests could possibly be dropped in screening evaluations of fillers in polyethylene. The yield strength at 80° C. and the guillotine test give essentially the same information as yield strength at 23° C. and Durometer "D" hardness, respectively, and thus are superfluous. Since Durometer "D" hardness and secant modulus correlate well, one of these tests also can be eliminated. These three tests may still be useful for the more comprehensive evaluations, since exceptions to the correlations do exist.

Summary and Conclusions

A study has been made of the effects of 26 different fillers on the properties of a medium molecular weight polyethylene resin. The fillers varied widely in the degree to which they changed such properties as tensile strength, yield strength, modulus of elasticity, brittle temperature, heat distortion temperature, and light stability.

One of the glass fiber samples caused the largest increases in yield strength and modulus. Asbestos shorts gave the greatest improvement in long-term strength. The least effect on all properties was found with either aluminum hydrate or Atomite wet-ground calcium carbonate. The results indicate that the addition of fillers to polyethylene may be used to broaden the applications of this already versatile resin.

Acknowledgements

The author wishes to express his appreciation to his colleagues in the Development Laboratories for their aid in the collection of data and the preparation of this paper, and to The Worthington Ball Co., Elyria, O., for permission to discuss their Guillotine Test. —THE END

Plastic-Clad Metal Design in Heavy-Duty Hydraulic Pistons
(*Continued from page 738*)

One of the most outstanding features of the finished piston head is its extremely high strength:weight ratio. No less important is the aluminum-laminate's ability to resist the action of hydraulic fluid, prevent seizing of the piston, and resist scoring. The laminate is stable dimensionally since it does not contract and, although in contact with oil, does not absorb enough to swell.

The successful performance of the Aerol strut in all types of aircraft points to the laminate-clad aluminum piston, as produced by Synthane, as a new material that can be used to make heavy-duty hydraulic pistons that are light in weight and suitable for use in dump trucks, construction and road-building machinery, materials handling vehicles, and other applications. —THE END

Plastics from the End-User Standpoint
(Continued from page 737)

—it indicates to me that she is beginning to learn. So is the retail salesman who cautions customers against exposing styrene products to the heat of the automatic dishwasher. But we must keep telling people about plastics. We must tell them from the rostrum, through the press and even across the living room. *Caveat emptor* (let the buyer beware) is an expression we want no part of. Our motto should be "Let the buyer be informed."

At the same time, however, we must be careful to avoid telling people "too much." By this I mean overpromoting our products through misleading advertising and publicity. For example, in my opinion, the fact that a molded product breaks but does not shatter cannot justify an ad playing up "new, shatterproof plastic housewares." Although the claim may have semantic truth, it lacks ethical justification and does not tell the whole story.

Finally, the urge to imitate should be resisted. Patterning plastic products after products made of other materials is a bit like going through a revolving door on the other fellow's push. Ersatz applications do little to serve the public or to enhance the prestige of the industry. Plastics, because of their inherent properties, can do many jobs that their non-plastic counterparts cannot do. We must make certain we are taking advantage of these properties, that we are designing around them, that we are exploiting them fully.

Essentially, ours is a job of public relations. Someone has aptly defined public relations as the production and distribution of a good reputation. That, in a nutshell, is our constant challenge.

—THE END

(PLASTICS TECHNOLOGY *does not censor in any way the opinions expressed by authors of our Guest Editorials.*)

Spread Coating Techniques
(Continued from page 745)

verse roll coating section would be required at the oven entrance. A companion line for finishing (see Figure 15) would include an unroll, single-color print head, spanishing or top-coating unit, drying oven, cooling rolls, and rewind.

Of course, there are many modifications of equipment that may be required to meet special requirements. For example, some spread coatings are partially set by contact with a smooth, heated drum prior to fusing. This is a parallel development to the starch coating of paper which is set against a chromium-plated, heated drum.

Spread Vs. Calender Coating

In comparing the spread coating technique with calender coating operations, the following advantages are cited in favor of spread coating:

(1) For accuracy of spread coating, the compound may be metered between rolls ground to a runout of 0.0001 inch. Furthermore, the coating rolls are not subject to the deflection encountered in calendering. The least that can be said for the reverse roll coating accuracy is that it is fully equal to that of calendering.

(2) For flexibility of operation on a wide range of coating thicknesses, the calender cannot equal reverse roll coating equipment.

(3) For control of coating weight, the usual beta-ray gages can be used immediately in back of the coating head at the front of the oven.

(4) For operating on short yardages, spread-coating equipment is more flexible than calendering equipment.

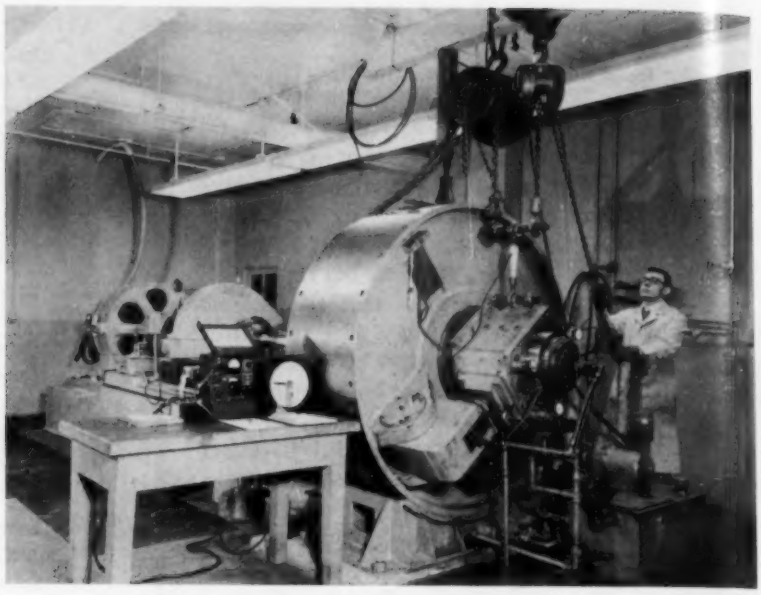
(5) To obtain optimum adhesion with minimum penetration of the fabric, calender-coated materials should receive a spread coating of adhesive. Spread-coating equipment also is frequently required in addition to calendering equipment in order to apply special top coatings and finishes. In other words, a calender is usually supplemented by spread-coating equipment.

(6) The most recent spread-coating machines have been set up to operate at speeds in excess of 60 yards per minute. This speed of operation places them in a favorable position for competition with calender-coated products. The best evidence of this fact is the continued prosperity of many spread-coating manufacturers in this country.

—THE END

Plastic Panels Support Thunderbird

The high strength of L-O-F Glass Fibers Co.'s Corrulux flat glazing is shown in the above photograph. A Ford Thunderbird, weighing over 3,200 pounds, and a 98-pound model are easily supported by four window pane-size panels. Weight at the contact area is approximately 800 pounds, or about 1,600 pounds per square foot. The Corrulux panes measure 14 by 20 inches, and are fastened with 2½-inch centers.



Testing Machine for High-Temperature Mill and Calender Bearings

One of the prime deterrents to the high-temperature milling and calendering needed for certain plastics is the lack of equipment capable of operating at roll-face temperatures of 500-600° F. Critical to the manufacture of such equipment are bearing design and the determination of lubricant composition to provide stable bearing lubricity under extreme conditions of heat.

Farrel-Birmingham Co., Inc., Ansonia, Conn., has developed a unique bearing-testing machine which permits the evaluation of bearing designs, materials, and lubricants under conditions of high load, slow speed, and elevated temperatures. This machine was designed and built by the company's engineers, and placed in full-scale research operation in a special laboratory adjacent to the firm's process laboratory. Studies to date have utilized both standard lubricants and the more recently developed synthetic oils of varied compositions and viscosities. This research is of a continuing nature, but enough data has already been obtained to enable the company to proceed with the manufacture of high-temperature units.

The firm has recently supplied laboratory mills designed for operation at temperatures up to 600° F., and is currently engaged in the manufacture of 26-inch mills and a 32 by 86-inch four-roll calender for operation at temperatures up to 500° F. The company also has supplied its own process laboratory with experimental-size mills and calenders designed for maximum roll temperatures of 600° F. These experimental units are frequently run at temperatures in excess of 500° F.

The accompanying photograph shows the bearing-testing machine in a special set-up with individual loads applied to simulate operating forces developed in calender and refiner work.

The machine has a basic journal size of 14 inches in diameter, and can exert a maximum load of 300,000 pounds on the bearings. This load is produced through a hydraulically-actuated lever system, with the actual force measured by means of strain gages. The main framework of the machine is circular, and can be rotated to apply loads in any desired direction. The driving means for the rotating journal include a torque meter for measuring friction torque. Thermocouples are placed in the bearing liners to record bearing temperatures during the test. Provision is made for heating the test journal to simulate actual operating conditions encountered in plastics mills and calenders during production work.

—The End

News of the Societies

einforced Group, SPE New York

The Reinforced Plastics Group of SPE's ew York Section held its first meeting of e fall season on September 26, at ufaro's Restaurant, Corona, L. I., N. Y. er 50 members and guests were in tendance.

D. V. Rosato, Raybestos-Manhattan, c., spoke on "Asbestos Reinforcements r Plastics," pointing out the outstanding aracteristics of his firm's Pyrotex felts d mats, and Novabestos papers and shioned glass-warp. The felts wet readily, taining their strength properties. This ature permits their use in continuous minating processes, prepregs, and dry y-ups. When used without a binder, they quire carriers through the resin bath d drying tower. The mats are pre-impregnated with phenolic resins, and can e cut to pattern. A three-month shelf life an be obtained with proper refrigeration.

Novabestos papers offer particularly mooth surfaces in laminations, plus a igh degree of compatibility. They are made by separating asbestos into single-component fibers which are held in dispersed condition. Cushioned glass-warps re made by impregnation with polyester r epoxy resins.

"Stanpreg—The All-Purpose Polyester Pre-Impregnated Glass Cloth", was discussed by Alex Sacher, Standard Insulation Co. The cloth obtains its flame resistance from a special resin formulation, rather than by the use of fillers which often reduce strength, flexibility, and flow. Stanpreg is reportedly self-adherent, but will not stick to the operator's fingers. Productivity and drapability is thus enhanced. A shelf life of more than six months can be expected.

October Meeting

"Mold Heating and Temperature Control" was the theme of October 31 meeting of the Reinforced Plastics Group, at Tufaro's Restaurant, Corona, N. Y.

William Hemmel, R. L. Faber & Associates, spoke on "Mold Heating and Temperature Control" pointing out that precise temperature control is essential to quality moldings. Temperatures of 90-1,200° F., can be maintained with properly installed, metal-sheathed resistance heaters, according to Mr. Hemmel, who described three essential types.

Strip heaters are used with large, flat platens having milled grooves in their rear faces. Resistance wires can be stretched to offer lower wattage in the center, higher at the strip ends. Tubular heaters have coiled resistance wires surrounded by refractory material in a seamless metal tube. Sheath materials can be aluminum, copper, steel, or Inconel; but must be used in compatible environments. Cartridge heaters are simply installed in close fitting, drilled or tapped holes. Further discussion was devoted to heater selection, especially with respect to the heating of cast resin dies.

"Liquid Heating" was covered by Bernard S. Breitman, American Hydrotherm Corp., N. Y. C., including water, heat-transfer oils, diphenyl chlorides, aryl silicates, diphenyl-oxide mixtures, tetra cresyl silicates, and eutectic salts. Advantages of liquid heating were reported as follows: maintenance of uniform temperatures; use of the same fluid throughout a range of heating cycles; accurate temperature control; immediate response; separate control over separate temperature zones; and control over the heating and cooling circuits. Many times calender speeds have been increased from 25 to 250 yards per minute through change to liquid heat, according to Mr. Breitman.

SPE Newark Section

Over 126 members and guests attended the October 10 meeting of SPE's Newark Section, which was held at the Military Park Hotel, Newark, N. J. A four-man panel consisting of H. E. Buecken, National Rubber Machinery Co.; A. A. Kaufman, Prodex Co.; W. H. Willert, F. W. Egan & Co.; and L. D. Yokana, Hartig Engine & Machine Co., discussed the **"Latest Developments in the Field of Extrusion."** James F. Carley, "Modern Plastics," served as moderator.

"Adiabatic Extrusion: What It is, How It's Done" was Mr. Buecken's subject. The principle involves generating internal heat through mechanical working of the material. High screw speeds are required, but localized over-heating is minimized since the barrel does not have to be hotter than the material. Most thermoplastics, except nylon, are adaptable to this technique. Screw design is important, and a compression ratio of 2:1 is recommended for granular feed.

Al Kaufman discussed **"Extruder Drives and Transmissions,"** stressing the importance of selecting a drive which would withstand the load. Where power transmissions operate at constant torque, the motor must have excess capacity in order to transmit power at low speeds. Worm transmissions are cheap, but give only about 65% power transmission. Herringbone reducers do not stretch like chain transmissions, and transmit up to 98% of the power. Perfect meshing of the gears is required, and the gear drive should be separated from the thrust assembly by a flexible coupling. For the thrust bearing, Mr. Kaufman recommended a SKF spherical rolling thrust.

"Pros and Cons of Heating Systems for Extrusion Cylinders" were covered by Bill Willert, who outlined steam, hot oil, and electrical heating. The oldest, steam, offers cooling as well as heating, but has distinct temperature limitations. Hot oil circulation systems suffer from high maintenance costs. Electrical resistance heater bands are the most common source of heat used in extrusion. Mr. Willert also discussed cooling by means of cold water, air tubes, and blown air.

"Effects of Different Screw Lengths on Extrusion" were outlined by Mr. Yokana, who brought out that increased length: diameter ratios give higher and more uniform pressures, better heating, better mixing, and increased output. Lower temperature gradients can be used with longer screws, an important factor in the extrusion of saran. Screws with an L:D ratio of 30:1 are effective in the compounding of carbon black in polyethylene. In addition, venting can be utilized with the longer screw.

SPE Kentuckiana Section

The October 17 meeting of SPE's Kentuckiana Section was held at Bauers Restaurant in Louisville, Ky., with 24 members and guests attending. James T. Roach, Phillips Chemical Co., addressed the group on "Marlex 50 Polyethylene," covering its properties, applications, and fabrication characteristics. The material differs from conventional polyethylenes in that it has a higher degree of crystallinity, higher density, and a higher softening temperature. Marlex 50 reportedly can be fabricated on conventional processing equipment.

SPI Information Program

The Reinforced Plastics Division, Society of the Plastics Industry, has announced the formation of an information program intended to present the practical significance of new and continuing developments in that field to manufacturers, engineers, architects, and designers. The move represents another step in the reinforced plastics industry's effort to help businesses make profitable, proper use of the plastic materials.

The information program will concentrate initially on making available the existing data on materials, processes, and applications, pointing out their economic significance to industrial and business users. These articles will be supplemented by a color slide film and booklet directed to the product engineer, designer, architect, and product manufacturer.

In these five Standard Units are all the necessary components to control effectively the degradation mechanisms that take place in polyvinyl chloride resins on aging, during heat processing or on exposure to sunlight. They are widely used alone and in combinations for specific effects in clear and opaque stocks. Their advantages have been proven over other tested materials, such as those based on tin (which frequently decolorizes effects of degradation without correcting them) or on lead (which frequently contributes to oxidation and breakdown on aging). We also supply combinations of components selected from these five Standard Units, to correct special conditions encountered in each Vinyl Processing Industry.

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NEWS of the INDUSTRY

New Name for Escambia

Escambia Bay Chemical Corp. has changed its corporate name to Escambia Chemical Corp., and has established permanent executive offices at 261 Madison Ave., New York, N. Y. The president, resin sales manager, and commercial development manager will all be located at this address.

Escambia's research and development department is located at Cambridge and Newton, Mass.; production facilities at Pensacola, Fla.

Wabash Opens Plastics Plant

A 15,000 square-foot plant was formally opened on September 21 by Wabash Rubber & Plastics Corp., a subsidiary of H. O. Canfield Co. Located in Seymour, Ind., the one-story unit will turn out plastic items for the appliance and automotive industries.

General Tire Acquires Byers

Acquisition of approximately 75% of the common stock and 40% of the preferred stock of A. M. Byers Co., Pittsburgh, Pa., has been announced by General Tire & Rubber Co., Akron, O. This move enables Byers to enter the plastic pipe business on a large scale. Anticipated sales volume is set at $10-million annually.

Byers is a well known producer of wrought iron piping, and has a wide-spread sales organization for handling non-corrosive pipe products throughout the United States. The firm also manufactures electric-furnace quality steel. Its two plants are located in Pittsburgh and Ambridge, Pa.

Plans Elastomers Lab Addition

A $500,000-addition to the recently completed Elastomers Laboratory at Chestnut Run, Del., has been scheduled by E. I. du Pont de Nemours & Co., Inc. Designed to expand customer service and develop new uses for urethane foams, the new wing will include pilot plant facilities, machinery, and other equipment for mixing and fabricating foams.

Both design and construction will be handled by du Pont's engineering department. Completion is expected by late spring of next year.

Atlas Acquires Thermaflow

As part of its program to expand operations in the plastics field, Atlas Powder Co., Wilmington, Del., has acquired Thermaflow Corp., of Tunkhannock, Pa. Atlas produces polyester resins, a major ingredient of Thermaflow compounds which consist primarily of high-impact reinforced plastic molding materials.

Plans to Produce Acetylene

Diamond Alkali Co., Cleveland, O., a major producer of chemicals for industry, plans to enter the acetylene-producing field. A multi-million-dollar facility will be built at Diamond's Deer Park plant for PVC resin at Houston, Tex., with construction slated to start in the fall of next year.

The unit will be under the management of the firm's chlorinated products division. Engineering studies for the project are presently under way; however, production capacity and cost of the project were not disclosed.

Schedules Lab Construction

A two-story research and development laboratory, scheduled for July, 1957, occupancy, is currently under construction adjacent to the executive and administrative offices of the Richardson Co., Melrose Park, Ill. A half million-dollar structure, the unit will provide 15,000 square feet of floor area divided into 23 by 35-foot modules. Certain of these will be combined to provide pre-pilot plants and larger laboratories.

Current research and development activities include synthesis, formulation, and applications testing for elastomers, resins, and plastics. The new facility will permit increasing these activities, plus diversification into new fields. Market information to supplement and guide the laboratory work will be provided by a newly-organized commercial development department.

Expands Petrothene Production

Full-scale commercial production of medium-density polyethylenes by the end of the year is the goal of National Petro-Chemicals Corp., New York, N. Y. A high-pressure production technique will be used to produce the materials, which will be sold under the firm's established trade mark, Petrothene. U. S. Industrial Chemicals Co., division of National Distillers Products Corp., will handle the marketing of the resins.

MCA has established arbitrary ranges of densities for low, medium, and high-density polyethylenes. They are, respectively, 0.912-0.925, 0.926-0.941, and 0.942-0.965. Petro's technique will produce resins with a density range of 0.92-0.95; however, the company plans to add only those polyethylenes in the medium-density range for the time being. Flexibility of the process permits production of the company's existing line of polyethylenes and the denser resins in the same equipment.

At the same time, National Petro-Chemicals announced an increase in total polyethylene production to 100-million pounds per year by mid-1957. The Tuscola, Ill., plant, which has been in operation since February of 1955, has been producing twice its design capacity of 26-million pounds. Expansion of the existing facilities is currently under way at a cost reported to be about $10-million.

Budd Expands Bridgeport Plant

A $1,750,000-addition to the Bridgeport, Conn., plant of The Budd Co.'s Continental-Diamond Fibre division, is currently under construction, with completion scheduled for next August. The 65,000-square foot structure will permit centralization of the entire sheet-fiber making operations, and a relocation of the Vulcoid operation from a leased facility.

Vulcoid, a resin-impregnated fiber with excellent electrical insulating properties, has been in short supply and is sold on an allocation basis. Centralization of the entire manufacturing operation is expected to increase productive capacity to the point of meeting all customer requirements.

Du Pont Department Expands

Substantial increases in the manufacturing capacities of its Clinton, Ia., and Circleville, O., plants have been scheduled by the film department of E. I. du Pont de Nemours & Co., Inc. New facilities at the Iowa unit will provide for a 10-million pound increase in the production of cellophane by mid-1958. Plans call for the addition of another 20 million pounds at other plants shortly thereafter.

A 50% increase in Mylar capacity will be provided through new construction at the Ohio plant. This project is scheduled for completion early in 1958. The Circleville unit, which started operations in July, 1954, is the first commercial installation for the production of Mylar.

Opens West Coast Facility

A new office and warehouse was opened at 2121 Yates Ave., Los Angeles, Calif., by Food Machinery & Chemical Corp.'s Ohio-

Apex division. New features include a tank farm with ample storage facilities for plasticizers, and a 10,000-square foot building. Sufficient land was obtained to provide for future expansion plans.

Glenn A. Farno, who had been representing Ohio-Apex in Los Angeles, will be in charge of the new operation. Local representatives of the Becco division and the Westvaco mineral product division will be housed under the same roof.

Celanese To Erect Polyol Unit

Celanese Corp. of America has started construction of a new polyol production unit at its Chemcel plant in Bishop, Tex., to meet the increasing demands for trimethylolpropane. This material, an intermediate in polyurethane synthesis, will be produced along with other polyols and aldols.

The new unit is scheduled for completion by Fall of 1957. In addition to the materials mentioned above, Celanese will produce a range of other products for use in the manufacture of alkyd resins and brake fluids.

Opens Injection Molding Plant

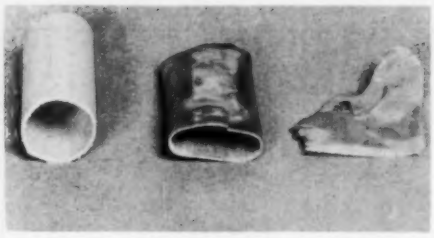
The new injection molding plant of MCI Plastics Corp., near Lakewood, N. J., is now in full production. Featuring the latest in automatic molding and materials-handling equipment, the plant will specialize in packaging and packaging components. Available machines range in size from 4-16 ounces, and the 10-acre plant site allows for additional expansion at a later date.

Kordite Polyethylene Plant

Textron, Inc.'s Kordite division has announced plans for opening a polyethylene processing plant in Jacksonville, Ill. The plant, which will occupy 175,000 square feet of floor space, is expected to commence operations around December 15. Polyethylene dry-cleaning bags and plain and printed produce bags will be produced.

Announces Expansion Plans

A new wing will be added to the Glenside, Pa., plant of Penn-Plastics Corp. This additional space will be used to house the firm's rapidly-expanding injection molding facilities, and will allow for enlargement of the finishing department. Additional compression and transfer molding equipment will be installed in the freed space.



Three samples of polyethylene after exposure to 300° F. for 96 hours. Sample on the right was untreated; center sample was irradiated; and sample on the left was modified by the Hyrad process and then irradiated.

Acquires Irradiation Process

A new process utilizing irradiation to modify and improve polyethylene and other polymers has been acquired by W. R. Grace & Co., New York, N. Y., through an exclusive licensing agreement with Sequoia Process Corp., Redwood City, Calif. Known as the Hyrad process, it reportedly imparts remarkable resistance to heat, increases tensile strength, and reduces cold flow and stress cracking.

The process reportedly combines the advantages of high-density polyethylene with the benefits of irradiation. Wire insulated with the material is run beneath a high-energy radiation beam of electrons. It can then be dipped into molten solder at 600° F., without damage. Grace's polymer chemicals division will supply the materials and technical know-how so that fabricators can use the process in manufacturing their own line of products.

Harold L. Gross

Forms Adhesives Division

A new division, to be known as the General Adhesives Co., has been formed by General Shoe Corp. The operation will be located at 6100 Centennial Blvd., Nashville, Tenn., and will manufacture resin-based solvent adhesives and industrial coatings; latex and resin dispersion-based adhesives and coatings; and rubber, synthetic rubber, and reclaim adhesives.

The new company will take over all of the industrial adhesive business of S. & F. Chemical Co., Inc., and will be under the direction of Harold L. Gross as vice-president and general manager. S. & F. will continue to operate, concentrating on problems peculiar to the shoe industry.

General Adhesives will be represented in the East by Torio Sales Co., College Point, N. Y.; in Ohio and environs by O'Donnell Rubber Products Co., Cincinnati; on the West Coast by George Rothage, Woodland Hills, Calif.; and other territories from the home office in Nashville. The compa will continue to handle the Isar-Chem Munich, Germany, line under license.

Forms Quelcor Subsidiary

Quelcor of Cincinnati, Inc., has be formed as a subsidiary of Quelcor, In Chester, Pa., for the purpose of extendi the firm's activities in the field of cor sion-resistant plastisols. John Kozacik w direct the operation as president, and w maintain offices at 1050 Hulbert St., Ci cinnati 14, O.

Plans Acrylic Polymer Plant

The $2,500,000 acrylic polymer plant o B. F. Goodrich Chemical Co. in Calve City, Ky., has reached the constructio stage. The new facility will include thre units: a process building, shop, and warehouse. Completion is scheduled fo October, 1957, at which time the plant wi employ 25-30 workers.

The polymers will be used for textil sizes, binders for foundry cores, floccu lating agents, and as chemical additives The new units will bring Goodrich's tota investment at Calvert City to more than $17-million. Present facilities include a plant for the manufacture of vinyl chloride monomer, and one for the manufacture o acrylonitrile.

Forms Plastics Molding Firm

A new plastics-molding firm, Dickmont Plastics Corp., will commence operations shortly in Stamford, Conn. The owners are Richard Scalise and Armand Marcucilli, both of whom have considerable experience in the field. Mr. Scalise will serve as president, and Mr. Marcucilli will be treasurer.

Polyurethane Process Patent

A basic process patent for the manufacture of flexible and rigid polyurethane foams and rubbers has been issued by the U. S. Patent Office to Mobay Chemical Co., St. Louis, Mo. The patent covers an injection technique which permits closer quality control as the basic ingredients are blended and mixed under pressure.

This process reportedly imparts greater uniformity to texture and cell structure of the foams, and affords closer control of properties in urethane rubbers. The patent, No. 2,764,565, was issued on September 25 in the names of Peter Hoppe, Erwin Weinbrenner, Cornelius Mulhausen, and Karl Breer, all associated with Farbenfabriken-Bayer, A. G., Leverkusen, Germany.

...formative Labeling Contest

The second annual labeling contest, ...nsored by the Society of the Plastics ...dustry, Inc., 250 Park Ave., New York ... N. Y., is now open for entries from ... companies and individuals in the ...ited States who are concerned with ...rketing plastic consumer products. ...wards will be made in each of the fol...wing categories: fashions, floor and wall ...verings, hardware, housewares, home ...rnishings, notions, toys, and miscella...eous items.

A distinguished panel of editors and ...ading merchandising authorities will ...rve as judges, and they will pick a ...al winner to receive the "Best in Show" ...formative Labeling Award. More than ...e entry may be submitted, provided sepa...te entry blanks accompany each label. ...ll entries and accompanying material ...come the property of the SPI, unless ...herwise specified. Winners will be an...ounced in January during the Chicago ...arket weeks for Housewares and Home ...rnishings.

...panded Production Facilities

A new plant, adjoining the present ...sembly unit, is being constructed by ...olded Fiber Glass Boat Co., Union City, ...a. When completed in January 1957, ...e plant will house the largest fiberglass ...reform machine ever built, and will have ... capacity of 30,000 boat hulls per year.

The huge preformer will have a 180-inch ...rntable, and a 200-hp. fan, and will ...rn gas at the rate of 8,500,000 Btu's per ...our. The plant will also house a 150-...ch preform machine, and two 750-ton, ...4 by 144-inch presses. Hulls are pres...ntly being produced in Ashtabula, O., and ...e shipped to Union City for finishing.

Du Pont Forms New Department

A new department, elastomer chemicals, has been created by E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. This department will be responsible for research, production, and sales of all products currently handled by the elastomers division of the firm's organic chemicals department.

This step becomes effective January 1, at which time George E. Holbrook, assistant general manager of the organic chemicals department, will take over as general manager of the elastomer chemicals department. Among the products which will be manufactured and marketed under his direction are neoprene, rubber chemicals, Hypalon synthetic rubber, and Hylene organic isocyanates for the manufacture of urethane foams.

Rezolin's new headquarters.

Rezolin Erects New Offices

A 3,000-square foot office building is being constructed by Rezolin, Inc., on its premises in Santa Monica, Calif. When completed, the new unit will house the firm's general and administrative offices, as well as the western sales divisional office. These functions will be moved from the old Los Angeles quarters by mid-November. Integration with the research and manufacturing units is another step in Rezolin's program to increase customer service.

BFG Chemical Opens Office

A modern, three-story office building featuring a glass and granite facade will serve as the new headquarters of B. F. Goodrich Chemical Co. Located at 3135 Euclid Ave., Cleveland, O., the new quarters will house approximately 300 employes.

Technical staffs, engineering, and purchasing departments will occupy the first floor, together with personnel and the library. Sales order service and accounting can be found on the second floor, and the third floor will accommodate the sales department, executive offices, and advertising. A conference room, telephone exchange, stock, vault, and storage area are located in the basement.

The unit measures 90 by 147 feet, for a total gross area of 52,000 square feet. It is entirely air-conditioned, with self-washing, electronic air filters. Accoustical ceilings with fluorescent lighting are featured throughout. Parking space is provided for 100 autos.

New headquarters of Goodrich Chemicals.

New England Storm Recovery

One of the hardest-hit companies during last year's hurricanes was United States Rubber Co., with its six New England plants. Total damage was estimated to be in excess of $12-million. The plants involved are located in Providence, R. I.; Woonsocket, R. I.; Chicopee Falls, Mass.; and three units in Naugatuck, Conn.

The company is far better prepared for future disaster. Nearly $750,000 has been spent for dikes, pumps, water-tight doors, and other flood precautions. There are improved hospital facilities as well as organized disaster teams. The Providence plant now has its own weather service, plus a seven-foot steel and concrete dike. Conduits have been relocated overhead, and all basement windows have been bricked up.

At Naugatuck, projects include elevation of power sub-stations, a water reservoir, gasoline-driven pumps, water-tight doors, plywood barriers, steam ejectors, and plugging of drains. A rip-rap dike, approximately 1,500 feet long by 10 feet high, has been installed.

Buys Cellofilm Industries

A group of private citizens has purchased the assets of Cellofilm Industries, Inc., Woodridge, N. J., from Universal, Paramount, and RKO, previous joint owners. The firm, which was established in 1916, manufactures nitrocellulose base solutions for lacquers, adhesives, and various other coatings.

The move should provide direct management for the organization, and Arthur M. Golden has been appointed executive vice president. Henry Eysmann and Stanley Eysmann, long-term associates of the firm, will continue in their present capacities.

Koppers' Design Competition

Five scholarships in industrial design will be the top awards in the third annual Design Competition for Plastics Housewares, sponsored by Koppers Co., Inc., Pittsburgh, Pa. One-year scholarships will be awarded to first-prize winners in each of the four competition classes, and the winner judged "Best-of-Competition" will be awarded a two-year scholarship. An innovation will be an award, at the judges' discretion, for the most original product in each class.

As was the case in previous competitions, honorable mention awards also will be made. The four competition classes are as follows: polystyrene products for use with food; polyethylene products designed for the same usage; polystyrene or polyethylene decorative products; and products of either material designed for home maintenance use.

Items entered in the competition may be molded, extruded, or fabricated of either

regular, modified, or foamed polystyrene; or of regular or modified polyethylene. Entries will be accepted from either the molder or proprietary manufacturer, and awards in the companies' names will be given to the originators of the designs submitted.

Production samples of each entry must be received no later than February 15, and should be addressed to: Administration Committee, Koppers Design Competition, 1313 Koppers Building, Pittsburgh 19, Pa. Entry forms may be obtained at the same address. Winners will be announced at an Awards Banquet in Pittsburgh on April 2, 1957.

Improved Epoxidation Process

A reportedly-improved process for in-situ epoxidation, involving cation exchange-resin catalysts, has been developed by Food Machinery & Chemical Corp.'s Becco chemical division, Buffalo, N. Y. Resin attack by the oxidizing medium is said to be overcome; a difficulty which had limited resin re-use.

The Becco process consists essentially of the following three steps: pre-washing and pre-treating the resin catalyst with mineral acid to render it metal-free; using a sequestering agent such as polyaminocarboxylic acid to tie-up metallic contaminants; and using a more highly cross-linked, sulfuric acid-type, cation exchange resin as a catalyst.

Any of the above steps reportedly will improve reaction performance; however, in combination, they offer excellent reaction efficiencies over prolonged re-uses of the resin. The process is applicable to batch and fixed- or semi-fixed bed continuous-flow systems, as well as to expendable resin processes.

U. S. Rubber Research Center

United States Rubber Co.'s new $4-million research center is now nearing completion, the corner stone having been laid on October 17. The center is located on a 100-acre tract near Preakness, N. J., and consists of a central administration building, an experimental laboratory, a chemical engineering laboratory, and a greenhouse for growing experimental rubber trees.

Approximately 400 scientists will make up the staff, including experts in the fields of plastics, rubber, textiles, and organic chemicals. Moving operations from Passaic, where the central laboratories are now located, will start soon after the first of the year.

Borden To Expand Facilities

Plans for a West Coast pentaerythritol plant with a productive capacity of 10-million pounds per year have been revealed by Borden Co.'s chemical division, New York, N. Y. The proposed plant, which will have facilities for producing up to 40-million pounds of formaldehyde annually, will be located in Dominguez, Los Angeles County, Calif., site of the firm's present synthetic resin and emulsion polymer plant.

Pentaerythritol manufacture is said to integrate efficiently with formaldehyde production and, when new formaldehyde units are added to the Kent, Wash., and Springfield, Ore., plants, Borden's West Coast capacity will exceed the combined production of all other formaldehyde suppliers in the area. The company currently has five formaldehyde plants located throughout the United States.

Pentaerythritol will be produced by a new process developed at Borden's Philadelphia research laboratories. The final product is reportedly free of deleterious mineral impurities commonly found in normal, technical-grade pentaerythritol. For formaldehyde production, Borden plans to use the Karl Fischer process, for which Borden has exclusive sub-license rights in the United States.

Topp To Acquire Heli-Coil

Shareholders of Topp Industries, Inc., Los Angeles, Calif., have voted to acquire the assets of Heli-Coil Corp., Danbury, Conn., makers of threaded inserts, in a move designed to provide broader service to the production and equipment-maintenance industries. The West Coast electronics and instruments firm plans to effect a three-way merger with Haller, Raymond, & Brown, Inc., a recently-acquired electronics research company located in State College, Pa.

Assets of the combined companies will amount to approximately $8-million, with annual sales of approximately $10-million. Topp spokesmen anticipate greater use of servo mechanisms, advanced electronic instrumentation, and industrial automation devices as an immediate result of their integrated facilities.

Dayton Sets Up Foam Division

A new division for handling the manufacture and sale of two-component, liquid polyurethane-foam systems has been established by Dayton Rubber Co., Dayton, O. As a result, processors will be able to purchase the two liquids custom-formulated to their particular specifications. Howard Noyes has been appointed manager of the new division.

In Brief . . .

Riverdale Color Co., Newark, N. J., appointed Plastics Molders Co., 55 Washington St., Chicago, Ill., as its sales agency in the greater Chicago-Milwaukee area.

United States Rubber Co., New York, N. Y., will co-sponsor eight of the most important college football games this fall over an NBC nation-wide television network of 176 stations. A number of plastic items will be featured during the time slotted to advertisements.

American Cyanamid Co.'s plastics resins division has appointed the following eight resale agents for its Laminac polyester resins: Beetle Boat Co., New Bedford, Mass.; Plastic Molders Supply Co., Fairwood, N. J.; Twentieth Century Chemical Paint Co., New Waterford, O.; Plas-Tex, Fort Worth, Tex.; H. D. Willcutts, Nashville, Tenn.; Hydrosol, Cicero, Ill.; Plastics Parts & Sales, St. Louis, Mo.; C. J. Hendry, San Francisco, Calif.; and Fiberplay, Inc., Seattle, Wash.

Seiberling Rubber Co., Akron, O., has appointed Industrial Roofing & Sheet Metal, Inc., Cleveland, O., as its sales representative for Seilon DP in northern Ohio. The material is a rigid PVC used for glazing and fenestration in building construction.

Manufactured Products Corp., Hartford, Conn., has announced a change in corporate name to Colt's Plastics Co., Inc. The change marks the end of reorganization within the company.

Flightex Fabrics, Inc., New York, N. Y., has announced the opening of a new glass cloth finishing plant at Clifton, N. J. The plant will be under the management of Carl Joseph, and is prepared to supply all standard glass cloths, finishes, and treatments for the industrial trade.

Bigelow-Sanford's fiber glass division has relocated its sales offices from New York City to Amsterdam, N. Y. The move is expected to centralize fiber glass operations and improve customer service.

B. F. Goodrich Chemical Co., has opened new headquarters at 3135 Euclid Ave., Cleveland 15, O. The new telephone number is Utah 1-8200.

B. F. Goodrich's industrial products division, Marietta, O., has introduced two new Koroseal wall covering and upholstery patterns. One is a deep-embossed pattern called Nassau; and the other pattern, Cork, looks like its namesake. Both are available in a number of colors.

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*T.M.

News from Abroad

Feed-Meter and Compensator for Injection Machines

A new automatic volumetric metering device, now being installed on the injection machines built by a Parisian firm, Jean Facon & Cie., includes two main elements: an oil-pneumatic pressure compensator, and an electric feed meter.

In these machines, a motor-driven lever acts on the injection plunger by means of a coupling system and a hollow, movable platen. The latter, a one-piece casting, comprises a cell and a very short cylinder in which a large piston can move with a stroke of 30 mm. One end of the piston is connected to the injection plunger, while the other is under constant oil pressure maintained by a head of nitrogen. It is designed to back up under difficult injection or molding conditions, the oil-pneumatic system absorbing part of the energy and returning it to the injection plunger at the end of the injection stroke. Thus, by maintaining a pressure at the end of the injection stroke, shrinkage of the material in the mold is compensated for by a supplementary supply coming from the pot.

The second element is the "Manodoseur" metering device. It operates in response to the compensating mechanism, and is intended to automatically correct any variation in feed volume during molding. An electric motor regulates the feed space between two feed pistons sliding inside a casing. The casing has one hole which goes under the hopper above the casing, and another hole over the inlet of the injection cylinder. At the rear dead point, the feed space is filled by gravity with the approximate amount of material required for the initial filling of the mold. A graduated scale indicates the approximate weight, in grams, of the material admitted.

A manometer mounted on the movable platen is connected with the electric motor, and receives no impulse until the end of the injection stroke. It has three pointers: E, F, and G, with E being between the other two. When the machine is at rest, E (which indicates pressure in the platen cavity) is in electrical contact with F, and maintains this contact so long as the pressure indicates that the mold has not been filled properly. If at the end of the stroke the pressure indicates that the mold still is not properly filled, F receives current and starts the motor which moves (for a preset time) in the direction that increases the feed space and, hence, the amount of material admitted.

After a few shots, the dose tends to slightly exceed the correct value. Then, the piston in the platen backs up, contact between E and F is broken, and feed remains constant. On the other hand, if too much material has been fed at the outset, E contacts G and causes the motor to reverse its movement so as to decrease the feed space. When molding conditions (external temperature, cooling or heating of the mold, etc.) begin to change, E moves to contact F or G, as the case requires.

This system is claimed to insure the same weight for all molded parts.

India's New Chemical Industry

Latest development in India's expanding chemical industry is the new polystyrene plant in Bombay, a joint endeavor of Dow Chemical Co., and Kilachand Devchand & Co., Ltd. The plant is scheduled for completion early next year, and will have a capacity of 500,000 pounds per month. Polychem, Ltd., a company formed by the two above-mentioned firms, will operate the facility.

India hopes to have a broadly-based chemical industry within 15 years, and the Indian government has agreed to contribute to the cause of industrialization. At present, industry is working towards the raw material from the finished product. This is particularly true in the plastics, dye, and rayon industries. Polychem's new project is the latest within this over-all trend.

Install Radiation Apparatus

Radiation apparatus has been installed by several leading British companies in the plastics and allied field. At the Rideal Laboratories of Monsanto Chemicals, Ltd., which were opened April 17, 1956, the effect of gamma and beta radiation on various plastics will be studied. This will be done at first with the aid of two separate 100-curie Cobalt-60 sources, but future modifications are expected to permit studies with up to 500 curies of Cobalt-60 and 1,000 curies of Cesium-137. As wide a range of reactions as possible will be investigated.

At the research department of Tube Investments Ltd., at Hinxton Hall, there now is available a Van de Graaff generator that can produce a 2,000,000-volt beam of radiation at high intensity. It is hoped to irradiate a variety of plastics on a semi-continuous basis with the help of several special devices now being designed. In addition, three other sources of radiation are available which will serve as auxiliaries to the main accelerator: (1) an X-ray machine operating at 250,000 volts; (2) another X-ray machine producing a beam of up to 50,000 volts, intended mainly for surface treatment; and (3) a high-intensity radioactive cobalt source giving gamma radiation (1,300,000 volts) of high penetration.

Metropolitan-Vickers Electrical Co., Ltd., has been carrying out work on irradiation for the past two years. A 4-MV linear accelerator, originally designed for X-ray therapy, is the source of high-energy electrons for experimental work at present, but machines are being constructed that will give energies up to 25 MV, and power output up to 30 kilowatts. Most of the work is done on polyethylene and results of an intensive investigation, carried out in collaboration with the ICI plastics division, on the changes effected in electrical and mechanical properties suggest that irradiation may make practicable the vacuum forming of polyethylene, since the temperature range for plastic flow can be increased considerably.

Standard Telecommunication Laboratories, Ltd., another firm that has become interested in the possibilities of irradiation, has installed a 2-MV Van de Graaff linear accelerator. British industry is being aided in this kind of research by the Technological Irradiation Group, formed at Harwell by the Atomic Energy Authority.

Campco Licenses Italian Firm

Pirelli, S.p.A., Milan, Italy, will manufacture Campco-type thermoplastic sheet under a license agreement with Chicago Molded Products Corp., Chicago, Ill. The Italian firm is a leading producer of plastic items, tires, rubber articles, and electric cables. It has 33 modern factories, the majority of which are in the Milan industrial area.

The agreement includes an interchange of technical information on sheet extrusion methods, processes, and machinery. Italian representatives will be sent to the United States for training in Campco manufacturing methods.

British Imports and Exports

British exports of plastics increased from 40,085 tons in the first half of 1955 to 47,193 tons in the corresponding period of 1956. The substantial rise was due chiefly to higher sales abroad of urea-formaldehyde resins and molding powders, polystyrene molding powders and acrylic sheet material. These increases were more than enough to off-set a heavy drop in exports of phenolic and cresylic resins and molding powders, as well as a slight decrease in vinyl resin and cellulose acetate sheet and extrusions. Exports of several other materials also increased somewhat. At the same time, imports of plastics materials dropped from 14,602 during the first half of 1955 to 11,450 tons during the corresponding period of this year.

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NAMES in the NEWS

Edward S. Coe, Jr.

Edward S. Coe, Jr., vice president and director of Farrel-Birmingham Co., has been appointed general manager of the company's Consolidated Machine Tool division, Rochester, N. Y. He succeeds **Lester D. Chirgwin,** who retires at the end of the year. Mr. Coe previously managed the Ansonia and Derby plants. **G. Wells Eighmy, Jr.,** replaces **Richard D. Mace** as New England sales representative; the latter having been appointed manager of foundries. **Gould C. Christensen** has been reassigned to the Lower Michigan sales territory.

John P. Brecker has joined Inyectora de Plasticos y Metales, Monterey, Mexico, as technical director. He previously served as chief engineer for Louis Marx & Co., and as general manager of Garfield Mfg. Co. He is a past president of SPE's Northwestern Pennsylvania Section.

Walter H. Kuhlen has been appointed technical sales representative for Borg-Warner's Marbon Chemical Division, covering Pennsylvania, New York, and points South. He recently completed two years of technical training at the firm's plant in Gary, Ind.

Herman Schneiderman

Herman Schneiderman has been appointed technical director of American Latex Products Corp., Hawthorne, Calif., manufacturer of polyurethane foams. Dr. Schneiderman formerly served as chief of Aerojet-General Corp.'s structural plastics group, and as senior research engineer at the Jet Propulsion Laboratory, California Institute of Technology.

John M. Van Loon, Jr., has been appointed representative for Peerless Molded Plastics, Toledo, O. He has opened offices at 16225 E. Warren, Detroit, from whence he will cover the entire state of Michigan.

David M. French has joined the research and engineering division of Wyandotte Chemicals Corp., Wyandotte, Mich. Dr. French previously served as polymer chemist for Acme Backing Corp., United States Rubber Co., and the National Bureau of Standards.

Baboo Ram Teree

Baboo Ram Teree has been appointed chief engineer of Greer Hydraulics, Inc., Jamaica, N. Y. He previously served as chief engineer for Weatherhead Co., as director of engineering for the New York Air Brake Co., and as hydraulic engineer with Curtiss-Wright Corp.

A. W. Low, formerly director of engineering for Monsanto Chemical Co.'s plastics division, has been appointed director of overseas plastics manufacture, replacing **Carl T. King,** who retires after 31 years of service. **M. O. Debacher** becomes manager of overseas plastics manufacture, serving directly under Mr. Low. **Francis E. Reese** has been named director of engineering.

Two other appointments find **H. K. Eckert** in charge of the division's West Coast manufacturing operations at Santa Clara and Long Beach, Calif., and Seattle, Wash. **Carl E. Pfeifer** will add to his other responsibilities, the direction of the new Saflex plant in Trenton, N. J.

H. H. Jones and **H. M. Shields** have joined the newly-established sales-engineering office of Regal Plastic Co., in Detroit, Mich. **R. F. Carlson, Jr.,** has been appointed sales representative in St. Louis, Mo.

Calvin P. Owen

Calvin P. Owen has been appointed te
nical sales manager of Narmco, Inc., S
Diego, Calif., producers of structural
hesives, and sandwich-type reinforced pl
tic structures. He previously served
director of customer services for the
Jack Scientific Instrument Co.

Robert C. Davenport, former vice pre
dent of Plastic Products Corp.'s sheet for
ing division, has joined Lamex Corp.,
sales manager for thermoplastic sheeti
He will make his headquarters in Le
minster, Mass. Mr. Davenport previou
served with Gregstrom Corp., Bolta Pro
ucts, and Hercules Powder Co.

Edwin F. Morfit has been appointe
head of manufacturing at the Frederick
burg, Va., plant of Sylvan Plastics, Inc.,
wholly-owned subsidiary of American Vi
cose Corp. Formerly with American Cy
namid Co., Mr. Morfit will direct the pro
duction of urea formaldehyde moldi
compounds.

Lloyd A. Dixon, Jr., has been name
West Coast sales manager of Houghto
Laboratories, Olean, N. Y. He most re
cently served as sales engineer and We
Coast manager of Kirby Fiberglass Co.

Ernest J. Hill

Ernest J. Hill has been appointed sales
manager of Colton Chemical Co., Cleve
land, O., a division of Air Reduction Co.
Former assistant sales manager, Mr. Hill
has more than 12 years experience in prod
uct sales to the plastics, paint, chemical,
rubber, and adhesives industries.

C. Edgar Maynard has been appointed
vice president in charge of the research
and development department for Pro-phy-
lac-tic Brush Co., Florence, Mass. The new
department will feature expanded staff and
laboratory facilities, and will formulate
long-range growth plans.

George Goldfinger has joined the staff of Armour Research Foundation of Illinois ...stitute of Technology, Chicago, Ill., as ...cialist in polymer chemistry. Dr. Gold...ger was previously associated with U. S. ...rest Products Laboratory, Polytechnic ...stitute of Brooklyn, Godfrey L. Cabot, ...d most recently, with the University of ...ffalo.

Richard Rieger has been appointed tech...cal representative for Bakelite Co.'s ex...sion materials division in the Cincinnati, ..., area. He succeeds **C. H. Jones,** who has ...nsferred to Union Carbide International ...o.

Milo Harrison Buzzee

Milo Harrison Buzzee has joined Tube Turns Plastics, Inc., Louisville, Ky., as director of marketing for custom-molded products. He most recently served as sales manager for Jackson & Church Co.'s plastics department. In 1950, Mr. Buzzee established a plastics department for General Tire & Rubber Co.'s mechanical goods division at Wabash, Ind., and Jeanette, Pa.

Christian W. Johnson has been appointed supervisor of polymer application research at Food Machinery & Chemical Corp.'s Chemicals Research Center, Princeton, N. J. He previously served with both USI and Sears Roebuck as director of resin research. **Daniel Warren,** formerly of St. Regis Paper Co.'s Panelyte division, will serve under Mr. Johnson.

David J. Rex has been named process engineer for the silicate, detergent, and calcium division of Diamond Alkali Co., Cleveland, O. He previously served as chemical engineer at Diamond's Painesville, O., works for the past nine years.

C. Howard Adams has been appointed manager of plastic product development for Monsanto Chemical Co.'s research and engineering division, St. Louis, Mo. He previously served as research group leader and research technical service supervisor for the firm's plastics division in Springfield, Mass. Mr. Adams is a member of the Editorial Advisory Board of PLASTICS TECHNOLOGY.

Arthur F. Roche

A. T. Maasberg has been appointed director of research and development for Dow Chemical Co.'s Midland division. A 20-year Dow man, Mr. Maasberg is succeeded as technical director of plastics production by **Arthur F. Roche,** who had been his assistant.

Charles W. Kleiderer

Charles W. Kleiderer has been elected executive vice president of Penn-Plastics Corp., Glenside, Pa., and its subsidiary, Penn-Plastics Mfg. Co. He joined the firm earlier this year as vice president in charge of sales, and as a member of the board.

"Colloid Corner" by COLUMBIAN

New "Medicine" for Controlling Cure of Polyester Resins

Colloidal carbon demonstrates new versatility in resins

New research by Columbian Carbon has eliminated the difficulties formerly experienced in curing polyester resins containing carbon black filler or pigment. In fact, Columbian's FURNEX® SRF carbon black can function to accelerate or retard cure rate and control heat build-up. Here's one more case demonstrating Columbian's ability to provide the right research and the right carbon to solve your product problems. To suit *your* need, Columbian Carbon Company can provide colloidal carbon in particle sizes from 9 to 90 millimicrons; rough-surfaced or smooth; in high or low structure forms; with controlled degrees of adsorption and absorption. All these qualities and more can be varied at will to custom-make an infinity of distinct colloidal carbons. Consult one of the largest producers of carbon blacks about your application . . . or *send now for our free technical book CEN-13-3.*

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New Materials

Write item numbers on Readers' Service Card to obtain more information.

Primary Vinyl Plasticizer

A mixed phthalate ester, designed as a primary plasticizer for vinyl films, sheeting, floor tile, extruded profiles, and most plastisol formulations, has been placed on the market by Barrett Division, Allied Chemical & Dye Corp. Called Elastex 48-P, the material is somewhat more volatile than DOP and features shorter fusion cycles because of lower fusion temperatures.

Improved resistance to elevated temperatures can be obtained by blending 48-P with a low-volatile plasticizer such as Elastex 90-P (DIDP). The new material may also be used in nitrocellulose lacquers.

Following are a list of typical properties and test data obtained with a typical vinyl sheeting formulation:

Material:	
Color, Hazen	30
Odor	Typical
Specific gravity	0.994
Acidity as phthalic acid, wt. %	0.01
Saponification number	304
Sheeting:	
Specific gravity	1.26
Hardness, Shore A	87
Torsional stiffness, T_f, °C.	–19.2
Brittle point, °C.	–27
Stiffness, Tour-Marshall, psi.	1,300
Tear resistance, lbs./in.	415
Modulus at 100% elongation, psi.	1,500
Ultimate tensile strength, psi.	2,750
Ultimate elongation, %	340
Volatility, accel. aging, wt. loss, %	12.1

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Curb static electricity troubles with plastic materials. Apply light applications of Statikil on plastic materials and machinery. This original, registered anti-static preventive eliminates static disturbances in manufacturing operations. Ideal wherever designs are placed on plastic by printing or painting. Prevents smearing caused by static attraction. Continued use is accumulative, reducing the frequency of static evidence. Mail coupon for full details.

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☐ One bulk gallon @ $15

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USED BY HUNDREDS OF LEADING PLANTS

Polyethylene Molding Material

A higher density polyethylene manufactured by the conventional, high-pressure process has been introduced by Bakelite Co. Designated DND-0400, the material reportedly features greater rigidity, higher gloss, harder surface, and improved heat resistance. Intended primarily for housewares, the new polyethylene's inherent flexibility prevents shattering or permanent denting of the finished product.

DND-0400 is a free-flowing, high melt-index material which readily conforms to mold surfaces. Shrinkage is similar to other Bakelite polyethylenes of 20-melt index. For optimum stress-cracking performance, stock temperatures in excess of 450° F., should be employed.

Typical properties are reported as follows:

Specific gravity	0.925
Bulk factor	1.85
Molding shrinkage, in./in.	0.01-0.04
Melt index	20-26
Molding temperature, °F.	450-550
Molding pressure, psi.	4,000-15,000
Dielectric strength, short time, volts/mil	550
Dissipation factor x 10^{-5},	
1 mc.	50
50 mc.	120
Dielectric constant	2.3
Tensile strength, psi.	1,700
Elongation, %	125
Stiffness modulus, psi.	30,000
Brittle point, °C.	–60
Volatility, 72 hrs., 82° C., %	0
Water absorption, 24 hrs., %	0.01

Readers' Service Item M-2

Woven Type-E Glass Rovings

Type-E glass, woven on a conventional loom into 140's roving, has been introduced by Ferro Corp.'s fiber glass division. Called Unirove, the roving is silane-sized for maximum strength in both wet and dry conditions. As is customary with most woven roving products, Unirove is made with 60 strands, or ends, in the roving skein.

Boats, containers, chemical tanks, and housings are typical applications for the material. Advantages and limitations place it between reinforcing mat and woven fabrics. Unirove delivers more reinforcement strength than mat; however, it does not equal some fabrics on a product strength per unit weight basis. It handles easier than mat in some lay-ups due to its continuous strands and the fact that there are no binders to dissolve, but is slower wetting and tends to slide more than most fabrics.

Standard widths are 38, 44, 50, and 60 inches. Custom widths from 38-72 inches can be supplied. Specifications are quoted as follows:

	Style 550	Style 54
Thickness, in.	0.034	0.03
Weight, oz./sq. yd.	25.7	23.8
Rovings/in. warp	5	5
Rovings/in. fill	5	4-5
Warp strength, lbs./in.	1,000	1,000
Fill strength, lbs./in.	1,000	850
Roll length, yds.	70	70

Readers' Service Item M-3

Silicone Release Agent

A colorless diethyl silicone oil, which serves as a release agent for silicone and natural rubber goods, microcrystalline waxes, and plastics, has been introduced by Union Carbide & Carbon Corp.'s silicones division, New York, N. Y. Designated L-41, the material is especially effective with products requiring subsequent painting due to the high-gloss finish which it imparts.

The oil can be applied by spray or swab as a dilute (0.3-1% oil) emulsion, or as a dilute (0.5-2% oil) solvent solution. The emulsion is normally used with hot molds, whereas the solution is preferred for cold molds where evaporation is slower. Addition of L-41 to coatings such as styrenated alkyds greatly increases mar and scuff resistance. It also minimizes blocking between stacked coated sheets.

L-41 is available in either 1,000- or 5,000-centistoke viscosities. Specific gravity is reported at 0.982-0.985, and refractive index at 1.447-1.449. Other properties include a flash point of 430° F., and a viscosity temperature coefficient of 0.77.

Readers' Service Item M-4

Long-Lasting Destaticizer

A new destaticizing compound, which prevents static-caused dust and dirt from collecting on plastics for months after one application, has been introduced by Merix Chemical Co. Known as Merix Anti-Static #79, the material's increased strength permits its dilution with equal amounts of water for dipping operations.

New additives are said to assure perfect run-off, fast drying, and spot-free, high-lustre finish regardless of application method. The concentrate, applied on one side, removes static on both sides of the item. Each gallon of the concentrate destaticizes approximately 4,000 square feet of plastic material.

Fully transparent, #79 has a faint, pleasant odor. Its pH is approximately neutral. Non-flammability is reported, and effectiveness is claimed up to six months after application. This latter feature depends, of course, upon such factors as friction, temperature, humidity, and handling.

Readers' Service Item M-5

Flexible Epoxy Composition

A low-viscosity epoxy resin, developed specifically as a flexible composition, has been introduced by Jones-Dabney Co. Designated Epi-Rez 507, the material can be combined with Epi-Rez 510 in various proportions to achieve almost any degree of hardness in cured compounds.

Curing is accomplished by the use of anhydrides, such phthalic, maleic, and chlorendic types. In general, cure is effected at 200-300° F. Reaction is slow, which means that the mixture has a long pot life and cures with a very low exotherm, Syntex 3154 accelerator provides a wide range of stability, plus speed of cure.

Physical properties are reported as follows:

Color	Pale
Opacity	Clear
Viscosity, cps	450-650
Specific gravity	1.13-1.15
Hydrolyzable chlorine, % max	0.15

Readers' Service Item M-6

Heat-Resistant Acrylic Resin

An acrylic molding powder, featuring outstanding resistance to heat plus improved flow, has been introduced by E. I. du Pont de Nemours & Co., Inc. Called Lucite 140, the material should be particularly valuable in the manufacture of auto stop-light lenses, speedometer dials, refrigerator parts, electrically-illuminated signs, airport landing lenses, surgical instruments, and other complex, hard-to-fill forms.

Improved flow provides thin parts with fewer surface blemishes and flow lines, and thicker parts without voids. Property data are listed as follows:

Tensile strength at —70°F., psi.	14,500
At 73°F., psi.	10,900
At 170°F., psi.	5,000
Elongation at —70°F., %	2
At 73°F., %	4-9
At 170°F., %	80
Modulus of elasticity at 77°F., psi.	400,000
Shear strength, psi	9,400
Impact strength, Izod, —40°F., ft.-lbs./in.	0.3
At 73°F., ft.lbs./in.	0.3
Stiffness at 77°F., psi	430,000
Flexural strength at 73°F., psi.	16,500
Compressive strength at 1% deformation, psi.	4,800
Hardness, Rockwell M	100
Flow temperature, °F.	302
Coefficient of linear thermal expansion per °F.	4×10^{-5}
Thermal conductivity, Btu's, Cenco-Fitch	1.4
Specific heat	0.35
Deformation under load at 122°F., 1,000 psi., %	0.7
Heat distortion temperature, 264 psi., °F.	202
At 66 psi., °F.	215
Dielectric strength, short-time, volts/mil.	415
Step-by-step, volts/mil.	355
Volume resistivity, ohm-cm.	10^{15}
Dielectric constant, 60 cycles	3.5
Power factor, 60 cycles	0.055
Index of refraction, n_D	1.49
Water absorption, %	0.25
Flammability, in./min.	0.9-1.3
Specific gravity	1.18
Mold shrinkage, in./in.	0.002-0.006
Compression ratio	1.8-2.2

Readers' Service Item M-7

VANSTAY Z

zinc bearing chelator for PVC resins imparts outstanding clarity, stability and resistance to sulfur staining when used as recommended with other VANSTAYS in many vinyl products.

Plastisols, Organosols, Extruded Goods

Use 1.5 VANSTAY R with .5 VANSTAY Z for maximum resistance to process heat and good service life.

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Use 1–1.5 VANSTAY HT with .5–1.5 VANSTAY Z to obtain the required protection.

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Use 1.5 VANSTAY N with 1.5 VANSTAY Z as the stabilizing system.

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New Equipment

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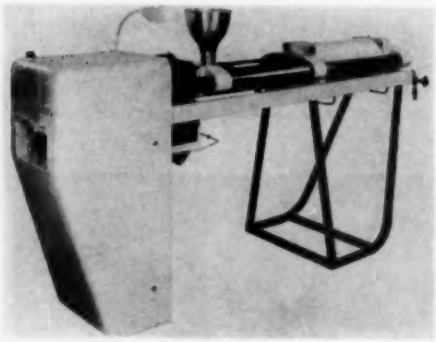

Hull-Standard's transfer molding press.

Transfer Molding Press

A fully-automatic transfer molding press for thermosetting plastics has been introduced by Hull-Standard Corp. Designated Model 99-A, the press uses general-purpose molding powder which does not require preheating. Standard mold blocks are held in position by a standard mold retainer set.

The press is designed primarily for low-quantity production runs of 5,000-250,000 pieces. Due to low mold costs and economical operation, it is claimed that parts can be produced more cheaply with Model 99-A than with larger conventional presses employing multi-cavity molds. The press is especially suitable for molding small parts, such as miniature electric and electronic components.

Tolerances up to 0.5 mils can be obtained, and the new press will mold very fragile parts. Flash is minimized, thus reducing finishing costs. One- to eight-cavity molds can be used, depending on part size. Maximum dimensions for a part produced in a two-cavity mold is 1⅛ by 1⅛ by ⅞ inches. Electrical requirements for the controls and heaters are 110 volts, 60 cycles, single phase, and 15 amperes. Finished holes are possible, since core pins can be piloted through the other half of the mold.

Following are specifications quoted for the press:

Maximum clamping tonnage, tons	15
Maximum transfer tonnage, tons	2
Diameter of transfer plunger, in.	0.75
Maximum transfer pressure, psi.	9,000
Mold dimensions, in.	2 x 5
Feeder capacity per cycle, cu. in.	0.9
Air pressure, psi.	80
Weight, lbs.	750

Readers' Service Item E-1

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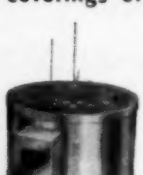

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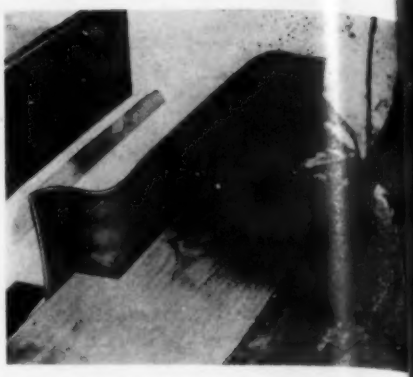
Rubber Electrical Blankets

Thin rubber blankets which heat by electricity are presently available from United States Rubber Co. Called Us-kon, the blankets have a sandwich-like construction with an electrically-conductive layer of rubber vulcanized between two sheets of non-conductive neoprene. The finished blankets are approximately ⅛-inch thick, and are energized by a flat conductor which runs along two parallel edges.

Outstanding feature of the blankets is their flexibility. Their shape conforms to any curve, corner, or crevice. Under thermostat control, they can reach temperatures up to 220° F. The heating area is marked with white lines, and is slightly smaller than the over-all size of the blanket. This insures electrical safety, and provides a margin for fastening screws, nails, or staples.



Blanket used for edge-sealing a plastic surface to an inside curve.

Standard Us-kon blankets are not intended for immersion in water or chemicals; however, special moisture-resistant blankets are available. Life expectancy is affected by the temperature at which they are used. The average blanket lasts 2,000 hours at 200° F., 6,500 hours at 175° F., and 20,000 hours at 150° F. They operate on 115 or 230 volts, and standard wattage is 150 watts per square foot. Weight runs approximately 8-16 ounces per square foot, and heated area ranges from three by 48 inches to 52⅜ by 124 inches.

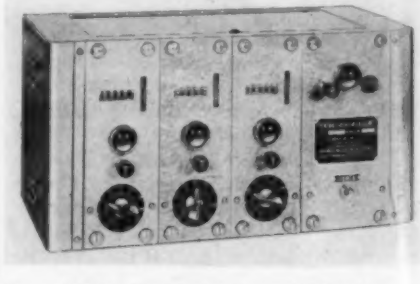
Us-kon blankets are expected to find wide application throughout the plastics industry for preheating, curing, lay-ups, and lamination under pressure. Pressures up to 200 psi., have been obtained.

Readers' Service Item E-2

Void Detector-Recorder

An electrical instrument for the detection of holes in electrically non-conducting material has been introduced by Viking Instruments, Inc. Designated the Viking Void Detector Type VR, the standard unit tests plastic films up to 0.025 inch thick and records holes as small as 1/64-inch in diameter. It consists essentially of a one-, two-, or three-position indicator unit connected electrically to feeler brushes.

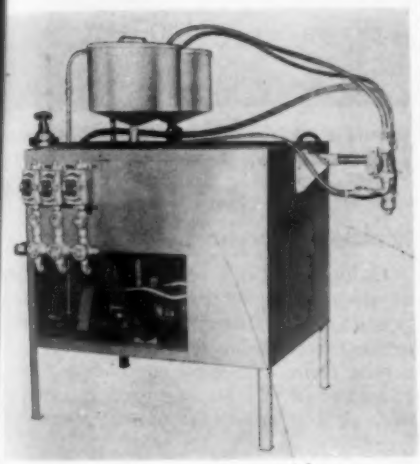
The brushes are attached to the roll, plate, or bar which is processing the material. Voids set up a low voltage pulse, which is transmitted to the indicator unit.



Type VRD-2 three-position void detector.

sured, and recorded. A sensitivity adment permits differentiation between le size to be detected. Counter units are ctrically actuated and manually reset. The standard model is designed for imsed voltage of 110 volts, 60 cycle AC. visual signal is incorporated into the it, and provisions are made for the conction of audible alarms and 24-hour cording equipment. Brushes are designed permit rapid adjustment for changes in eb widths without interrupting a productn run. Extremely flexible, they exert no brasive action on the material being sted. Dimensions for the three-position nit are eight by eight by 16 inches.

Readers' Service Item E-3



Klauder Williams' Foam Master unit.

Two-Component Foam Machines

A line of simplified machines for making both rigid and flexible polyurethane foams is presently available from Klauder Williams Co. Called Foam Master, the line includes large production models and small, portable units for pattern and development molding. Klauder Weldon Giles Machine Co., and Gabriel Williams Co., pooled their efforts in developing the master model.

Foam Masters are so designed that component flow can be regulated to produce a wide range of end results. Components are placed in separate tanks above the machine, and are gravity-fed to separate, positive-displacement pumps. These, in turn, are equipped with variable-speed changers and revolution-counters for adjustment to any desired formulation or volume within the capacity range.

The revolution-counter provides simple adjustment of pump speed for quick, easy return to previous formulations. The stainless steel mixing head is interchangeable with a portable head attachment for foamed-in-place operation, and with a transverse reciprocating mechanism for mobile head travel. Individually motor-driven, it has a separate speed changer for volume or formulation adjustment.

The standard unit has a capacity up to eight pounds per minute. Elements are mounted in a cabinet-type aluminum housing with a welded-steel frame. The two tanks are of welded, stainless steel construction, and have a capacity of seven gallons. Both rigid and flexible piping are provided, the latter being fitted with snap-on couplings for quick detachment and reassembly after cleaning.

Resistance heaters are provided for the rigid feed lines and, where inordinately high viscosities are used, tank or immersion heaters are available. Three-way bypass valves at the mixing head afford better production control by eliminating raw material waste during mold swing-overs. The standard unit measures 48 by 54 inches, and stands 52 inches high. Weight is 750 pounds.

Controlled foaming is obtained, obviating the need for additional whipping or frothing. Mixed material may be fed immediately into molds. Foam Masters have been used to handle all types of two-component resin systems, including epoxy and polyether.

Readers' Service Item E-4

new RC plasticizer

D-31

economical, top-quality replacement for N-ODP now available!

The result of exhaustive laboratory development, RC Plasticizer D-31 is available now as a low cost replacement for N-ODP. This new product has comparable physical properties, brittle point and efficiency, but with *much lower volatility* and *soapy water extraction.*

COMPARISON PROVES LOW-COST D-31 IS BETTER . . .

	N-ODP	RC D-31
Polyvinyl chloride	100	100
Plasticizer	50	50
Plumbosil B	3	3
Stearic Acid	1	1
Tensile, psi	2680	2750
100% Modulus, psi	1500	1520
Elongation, %	305	330
SPI Volatility	−0.9	−0.6
SPI Brittlepoint		
Passed, °C.	−25	−25
Failed, °C.	−30	−30
Soapy Water Extraction	%−0.3	+0.2
Oil Extraction	%−6.5	−7.4

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WRITE TODAY! Ask for our technical data sheet on new D-31. We'll be glad to send you samples!

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New Products

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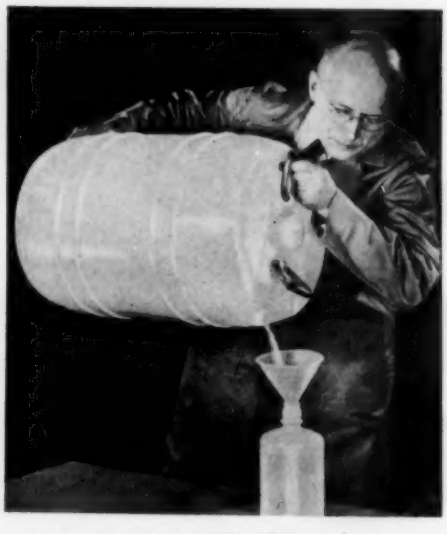


Plax Corp.'s new polyethylene drum.

New-Type Polyethylene Drum

A 13-gallon polyethylene drum featuring two folding handles, pouring spout, separate filling and venting opening, bottom hand-grip, and side-strengthening ridges, has been introduced by Plax Corp. Lightweight, the container is inert to corrosives and is unbreakable.

Provisions have been made to permit stacking. Colored folding handles and the filling and pouring necks are recessed at the top of the drums. Top and bottom contours are convex to permit containers to nest securely on top of one another. Design originated in Italy, with Montecatini and Pirelli.

Readers' Service Item P-1

Anti-Static Industrial Coating

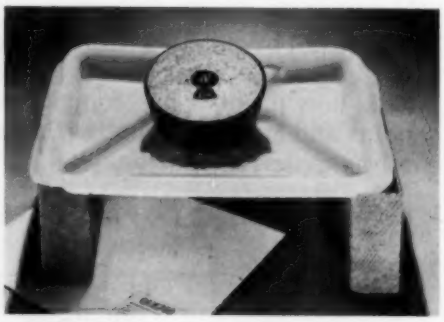
An anti-static coating for industrial equipment, utilizing Du Pont's Teflon fluorocarbon resin as a base material, has been introduced by General Plastics Corp. Called Gencote 108, the formulation retains all the characteristics of Teflon, but reverses its electrically-insulative properties to make them conductive. A four-mil thick film with a contact area of approximately ½-square inch has a resistance of one ohm.

Gencote 108 applied to blender walls to prevent static build-up.

Gencote 108 provides an anti-stick, dry-lubricated, chemically-inert surface in addition to its anti-static features. Applied to the inner surfaces of chemical blenders, it prevents light powders from sticking to the sides. On conveying equipment, this feature reduces costly clean-up time.

Surfaces can be coated in coating thickness multiples of ½-10 mils on any type of metal or other materials which can withstand 700° F. This is the temperature required for the baking process. As a result, electrically-conductive surfaces can be applied over an insulating base such as glass, ceramics, or porcelain.

Readers' Service Item P-2



Vacuum-formed tray of Campco rigid polyethylene sheet.

Linear Polyethylene Sheet

Extruded, rigid polyethylene sheets of both the Ziegler and the Phillips types have been placed on the market by Chicago Molded Products' Campco division. Previously available in calendered films, the linear polyethylene sheet is suitable for vaccum forming.

Resistant to heat distortion and chemical attack, the sheet can be formed into complex shapes with deep draws. Certain modifications are required in the heating equipment, however, to accommodate the material's different heating and cooling cycles, and its tendency toward plastic "memory".

Following are a list of properties as determined by ASTM test methods:

	Ziegler Type	Phillips Type
Specific gravity	0.945	0.9[illegible]
Water absorption, 24 hrs., %	0.1	None
Heat distortion, 66 psi., °F	140	168
Tensile strength, psi.	3,200-3,500	5,100
Elongation, %	300	—
Modulus of elasticity, psi. x 10^5	0.64-1	—
Flexural strength, psi.	2,200-2,300	—
Impact strength, notched Izod, ft.-lbs.	2.5-5	3
Rockwell hardness, R scale	32-43	—
Modulus of stiffness in flexure, psi.	75,000-125,000	140,000

Readers' Service Item P-3

Realite 6500 unit features Prismalume molded acrylic enclosure.

Molded Acrylic Luminaire

Holophane Co.'s new Realite 6500 line of fluorescent lighting fixtures now features the Prismalume, a prismatic luminaire molded from Rohm & Haas Co.'s Plexiglas acrylic resin. The slim, compact enclosure offers the advantages of prismatic light control, as well as weight and safety advantages.

The unit comes in four- and eight-foot lengths, with each four-foot hinged section incorporating two 24-inch Prismalume elements. These are held in position by a light steel door, which has grooved edges for sliding the acrylic sections. Two F-40 T-12/RS fluorescent tubes are accommodated in each four-foot length.

Normally ceiling-mounted, the Realite 6500 units are also available with pendant hangers. All metal parts are rust-inhibited and finished in a hot-bonded white enamel. Continuous runs are made up by repeating a unit and attaching ends. Fill-in sections are added as required. Mounting straps are used at the ends and at each coupling point. Safety fuses prevent overheating in case of ballast failure.

Readers' Service Item P-4

Phenolic Silk-Screen Frames

Hard-surfaced, splinter-resistant frames for silk screens are being molded from Durez phenolic resin by Kurz-Kasch, Inc. Available through Tipp Supply Co., the frames offer a number of advantages over the wooden frames presently in use.

Laminated phenolic frame holds silk screens securely.

Phenolic frames are stronger than wooden frames. They can be reused, and are lighter and easier to keep clean. The frames are molded with a uniform cording groove. This groove has a smooth bevel which allows the silk to be stretched without tearing. Older techniques employed tacks or staples to hold silk in the frame, but this formed valleys and subsequent variations in color density. The new "cording in" process assures uniformity and better color registration.

Readers' Service Item P-5

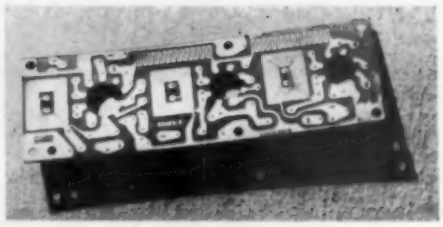
Reinforced Plastic Jeep Roofs

Use of fibrous glass-reinforced polyesters in the automotive industry has been expanded by Willys Motors, Inc., with its new Dispatcher Jeep. The auto features a top fabricated with one layer of Bigelow-Sanford's five-ounce Format, a mechanically-bonded mat of glass fibers.

Molded Fiber Glass Body Co. molds the top, using matched metal dies and one of the world's largest hydraulic presses. The Dispatcher has a two-wheel drive, and is designed as a basic transportation and delivery unit. Cargo area measures 40 cubic feet.

Willy's Dispatcher Jeep has glass-reinforced polyester plastic roof.

Readers' Service Item P-6



Synthane's paper-base phenolic laminate.

Paper-Base Phenolic Laminate

Synthane Corp., has developed a paper-base phenolic laminate with good cold-punching and cold-shearing properties, in addition to excellent electrical characteristics. Designated P-25, the new grade reportedly eliminates hot-punching shrinkage allowances, and even the need for heating equipment. It is especially recommended for copper clad laminates used in printed circuitry.

P-25 is available in both plain and copper-clad sheets measuring 36 by 36 inches. Thicknesses range from 1/32-1 inch. Properties are quoted as follows:

Tensile strength, lengthwise, psi.	12,400
Crosswise, psi.	9,500
Compressive strength, psi.	25,000
Specific gravity	1.3
Coefficient of thermal expansion, °C. x 10^{-5}	2

Readers' Service Item P-7

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HENDRICK PANEL SAWS
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This is a Model MLR-6 Panel Saw with a cutting capacity of 4½'. Fully automatic and manual models available with capacities of 4½' — 12½' and motors from 1—3 HP. Write for illustrated folder.

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MANUAL AND AUTOMATIC MODELS

New Literature

Write item numbers on Readers' Service card to obtain copies.

"Vertical Injection Molding Machines." Bulletin 627-B. Watson-Stillman Press division, Farrel-Birmingham Co., Inc. 8 pages. Specifications and operating features are listed along with photographs of the one-, two-, six-, 16-, and 24-ounce capacity machines. Advantages of the vertical method are explained.

Readers' Service Item L-1

"Poly-Koolfoam." Form No. A-2136. Dayton Rubber Co. 16 pages. This profusely-illustrated bulletin describes Dayton's polyurethane foam, its properties, fabrication, and applications. The firm's research facilities also are described.

Readers' Service Item L-2

"Empol 1022 Polymerized Fatty Acid." Emery Industries, Inc. 20 pages. The booklet contains complete descriptions, specifications, and shipping data on the material which is used in the following applications: adhesives, coatings, corrosion inhibitors, de-emulsifiers, emulsifying agents, films, foams, plasticizers, lubricants, and polyesters. An end-use bibliography is included.

Readers' Service Item L-3

"Vinyl Acetate Monomer." Air Reduction Chemical Co. 20 pages. Essential information on physical properties, grades, specifications, handling, polymerization, and chemical reactions of the material are included in this bulletin. All data are fully referenced.

Readers' Service Item L-4

"Pliovic AO Dispersion Resin for Organosols and Plastisols." 56-122. Chemical division, Goodyear Tire & Rubber Co. 1 page. Properties, compounding features, and advantages are given in this bulletin.

Readers' Service Item L-5

"Ferro Inorganic Pigments." Ferro Corp. 4 pages. This color chart folder illustrates Ferro's line of inorganic pigments, both in masstone and 50% tint. Physical properties and composition are listed.

Readers' Service Item L-6

"Eastman Plastic Master." Form C 789. Eastman Machine Co. 4 pages. The Plastic Master is a machine for cutting plastics without fusing. Two models are currently available: the Blue Streak, with a wavy-edged straight knife; and the Lightning, with circular knife. Photos are included.

Readers' Service Item L-7

"Success Is Certain with Cel-Fibe, the Superior Cellulose Wadding." Cel-Fibe division, Personal Products Corp. 8 pages. This cellulose wadding comes in many standard forms with varying properties. It can be backed, embossed, and laminated to plastics and other materials. Primary uses are in the protective packaging and cushioning fields, and in bedding and furniture applications.

Readers' Service Item L-8

"Celogen-AZ." Bulletin No. 4. Naugatuck Chemical, division of United States Rubber Co. 12 pages. Properties are listed for this nitrogen blowing agent, which is used in the production of expanded vinyls. The closed mold and the open or free-blow plastisol methods are described, and promoters for the material are listed with their respective decomposition temperatures.

Readers' Service Item L-9

"Mylar Cost and Property Comparator." Film Department, E. I. du Pont de Nemours & Co., Inc. This handy slide rule enables designers and engineers to compare costs and physical properties of Mylar polyester film with those of acetate, acetate butyrate, polyethylene, polystyrene, rag paper, varnished cambric, PVC, and rigid PVC.

Readers' Service Item L-10

"Polyethylene Processing Tips." U. S. Industrial Chemicals division, National Distillers Products Corp. 8 pages. This combined folder-inserts bulletin offers information on the firm's Petrothene polyethylene resins, operating conditions, and U.S.I. services to the processor.

Readers' Service Item L-11

"Pigment Dispersions." Pennsylvania Color & Chemical Co. 4 pages. Formulation data is given for the firm's nitro cellulose pastes, lacquer chips, nitrocellulose ink bases, ethyl cellulose bases, vinyl pastes and chips, plasticizer pastes, acrylic pastes, acetate-butyrate chips, styrene co-polymer pastes, universal tinting pastes, ester gum pastes, and urea pastes.

Readers' Service Item L-12

"Properties: Plio-Tuf C-75 for Calendering." 55-192A. Goodyear Tire & Rubber Co. 2 pages. Physical properties are given together with an analysis of same, and information is included on chemical resistance and electrical properties.

Readers' Service Item L-13

"Electronic - Controlled, Precision - Engraved Applicator Rolls." Modern Engraving & Machine Co. 2 pages. A guide for determining the amount of dry solids in solution, this flyer includes three equivalence charts for Memco cells used in offset, directly, and for heavy applications.

Readers' Service Item L-14

"HB-40." Technical Bulletin 0-104. Monsanto Chemical Co., Organic Chemicals Division. 12 pages. Properties, characteristics, and applications are given for this new extender-type plasticizer.

Readers' Service Item L-15

"Lytrons." Bulletin No. 1005. Monsanto Chemical Co., Plastics Division. 28 pages. Properties and applications for these synthetic polyelectrolyte thickeners are given together with data in graphic form. These materials are used in latex and other aqueous dispersion systems.

Readers' Service Item L-16

"Styrene Monomer Storage and Handling." RM-10. Monsanto Chemical Co. Plastics Division. 5 pages. This bulletin gives a complete breakdown on handling of the material, as well as its physical properties in pure form.

Readers' Service Item L-17

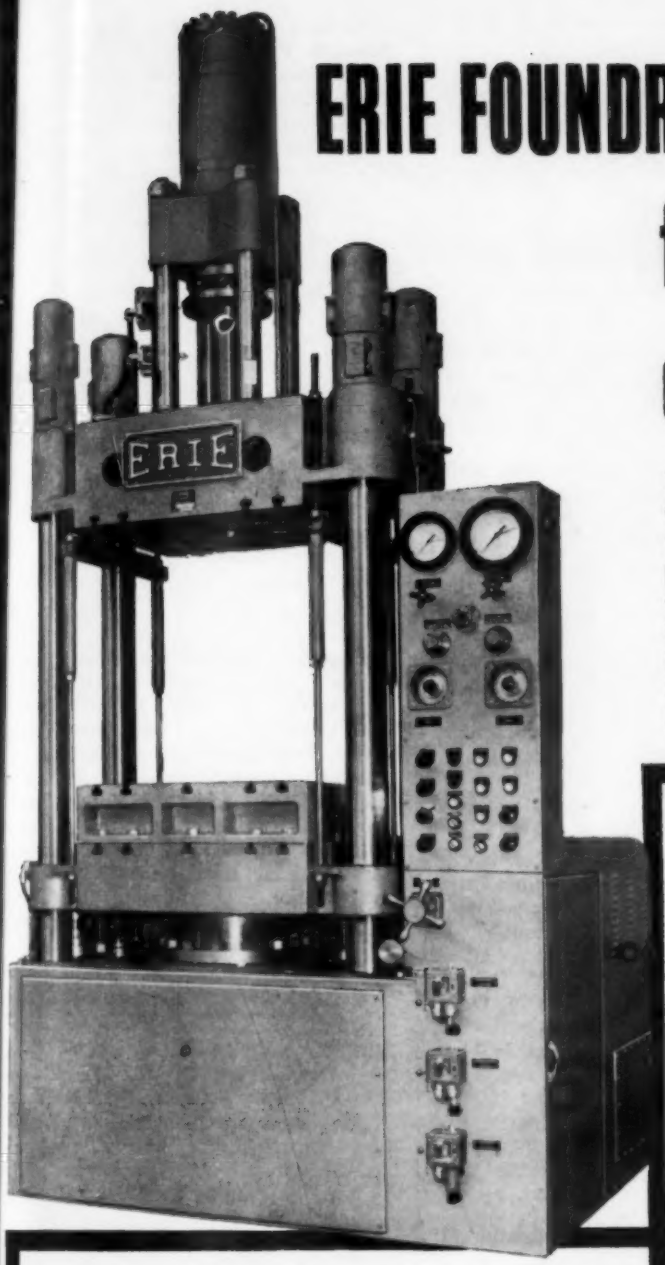
"Fluoroflex-T Laminated Pipe." Resistoflex Corp. 13 pages. This illustrated booklet, which includes specification and price inserts, describes the firm's insert and corrosion-proof Teflon pipe and hose assemblies.

Readers' Service Item L-18

"Coating Resins." American Cyanamid Co. 48 pages. Specifications, formulations, and applications are listed for Cyanamid's Rezyl resins, Cycopol resins, Beetle resins, Cymel resins, and phthalic anhydride.

Readers' Service Item L-19

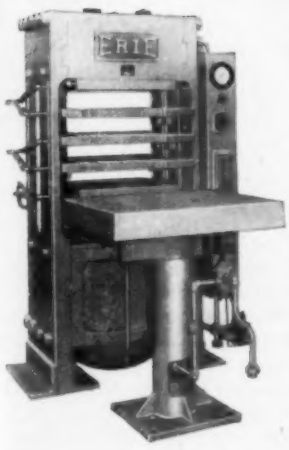
ERIE FOUNDRY HYDRAULIC PRESSES for MOLDING RUBBER and PLASTICS



Hydraulic presses, designed and built by Erie Foundry Company are precision presses in every sense of the word . . . tonnages are accurate and precisely applied, platen temperatures are closely controlled, and molding cycles perform at split second timing. Erie Foundry Hydraulic Presses are flexible too . . . readily adaptable to almost any molding job. Write for complete information on these presses or on the complete line of Erie Foundry rubber and plastic hydraulic presses.

TRANSFER and COMPRESSION MOLDING PRESS

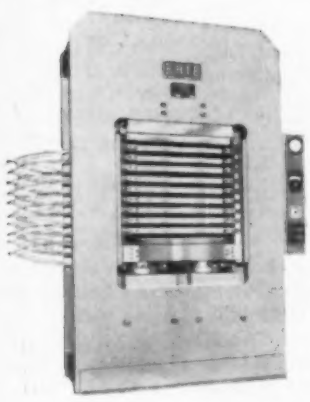
A flexible press for both compression and transfer molding is this 200 ton self-contained semi-automatic Erie press. This machine is equipped with a 55 ton transfer cylinder which can be timed separately from the main ram, as well as knock out cylinders on the bolster and a mechanical knock out for the top mold. Automatic cycling can be easily arranged to mold almost any product.



STRAIN PLATE PRESS for MINIMUM DEFLECTION

The platens stay parallel within .002" on this 314 ton press built of low-stress construction throughout. This press can be converted to transfer molding if desired.

We built the hydraulic lift table, too.



HOT PLATEN PRESS OF ECONOMICAL DESIGN

This 800 ton press is compact and rigid. Accurate platen alignment is maintained with minimum deflection over entire range of platen temperatures.

Hydraulic Press Division

ERIE FOUNDRY CO. ERIE, PA.

SINCE 1895 THE GREATEST NAME IN HYDRAULIC PRESSES

ERIE

Book Reviews

"Phthalic Anhydrides—Chemical Safety Data Sheet SD-61." Manufacturing Chemists' Association, Inc., 1625 Eye St., N. W., Washington 6, D. C. Paper, 8¼ by 10¾ inches, 18 pages. Price, 30¢.

Physical and chemical properties are listed, along with a discussion of the fire, corrosion, and explosive hazards encountered in the handling and use of commercial phthalic anhydride. Specific points include the shipping containers, conditions of storage, protective equipment, and waste disposal.

"Toluene—Chemical Safety Data Sheet SD-63." Manufacturing Chemists' Association, 1625 Eye St., N. W., Washington 6, D. C. Paper, 8¼ by 10¾ inches, 22 pages. Price, 30¢.

Properties, hazards, engineering control, employe safety, fire fighting, handling and storage, tank and equipment cleaning, waste disposal, and medical management are described in detail. Toluene in industrial grades may contain up to 50% benzene in vapor concentration, among other hazards.

"Warning Labels." Manual L-1. Manufacturing Chemists' Association, Inc., 1625 Eye St., N. W., Washington 6, D. C. Paper, 6 by 9 inches, 116 pages. Price, $1.00.

This is the fourth revision of a guide for the preparation of warning labels for hazardous chemicals. Three separate sections are included: preparation of warning labels; illustrative warning labels for industrial chemicals; and illustrative warning labels for pesticides. Tables of precautionary statements are included.

"A Study of Plastic Pipe for Potable Water Supplies." National Sanitation Foundation, School of Public Health, University of Michigan, Ann Arbor, Mich. Paper, 7¼ by 10¾ inches, 94 pages. Price, $1.00.

Part I describes the project, the plastics used, and the various exposures undergone by the piping. The majority of the booklet, Part II, is devoted to describing extraction tests, taste and odor tests, chlorination reactions, long-range effects, animal feedings, and appraisal. Three appendices are included, covering susceptibility of plastic materials to animal and microbial attack, control and standardization, and chemical test methods.

"First Joint Military-Industry Packaging and Materials-Handling Symposium." Order PB 121350 from OTS, U. S. Department of Commerce, Washington 25, D. C. 695 pages. Price, $6.00.

Proceedings of the symposium, which was held in Washington, during October of 1955, was compiled by the Navy. Packaging and materials-handling specialists from the armed forces and from industry presented papers, 30 of which are presented in their entirety. Among the subjects discussed are new developments, materials handling in production, transportation and warehousing, selection of packaging methods, reducing transportation costs, packaging and handling, packaging requirements, automatic packaging, and automation in handling.

"High-Temperature Creep-Rupture Properties of Glass-Fabric-Plastic Laminates." J. VanEcho, G. R. Remely, and W. F. Simmons, Wright Air Development Center. Order PB 121082 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 51 pages. Price, $1.50.

Creep and creep-rupture tests in both tension and compression were conducted at room temperature, 300° F., and 500° F. on three glass-fabric base laminates: a silicone, DC-2104; a phenolic, CTL-91LD; and a polyester, PDL-7-669. Results indicated that the polyester laminate had the highest strength in tension at all three temperatures, while the phenolic showed the highest compressive strength. Both, however, evidenced a rapid decline in creep strength with time at 500° F. A deterioration test proved the silicone to be the most stable of the three. Preliminary short-time tensile tests showed about the same strength relationship as reported for the creep-rupture tests.

"Thin Films of Polytetrafluoroethylene Resin (Teflon) as Lubricants and Preservative Coatings for Metals." V. G. FitzSimmons and W. A. Zisman, NRL. Order PB 121161 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 32 pages. Price, $1.00.

This report summarizes experimental work and field tests on a number of applications of Teflon to guns and ammunition, submarines, aircraft, and other equipment. An appendix contains a number of essential techniques for assuring minimum friction, maximum durability, good adhesion, and high resistance to corrosion. The material is applied as a thin film for optimum results.

"Effects of Molding Pressure on Strength Properties of Several Types Glass-Fiber Reinforced Plastics," S. Toner, I. Wolock, and F. W. Reinh Wright Air Development Center. Or PB 121196 from OTS, U. S. Departm of Commerce, Washington 25, D. C. Pa 73 pages. Price. $2.00.

The effects of molding pressures on mechanical properties of polyester-gl laminates are evaluated. The lamina reinforced with woven glass fabric or w two- or eight-ounce unoriented mat, w tested for flexural, tensile, and compress strengths, plus flexural and tensile mod of elasticity. Properties of laminates fab cated in a closed mold do not vary a preciably; however, flexural and tens properties of panels formed in an op mold increase with pressure up to 10 p Compressive strength showed a tendency decrease with increased molding pressur

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"Chemical Finishes for Glass Fiber." Erickson and I. Silver, Naval Ordnan Laboratory. Order PB 121165 from OT U. S. Department of Commerce, Washin ton 25, D. C. Paper, 29 pages. Price, 75

Testing of ten finishes with RN-48 an Selectron 5003 in glass cloth laminat proved the Bjorksten finish most effecti in improving the high strength of resin glass cloth laminates under both wet an dry conditions. Improvements indicate th the strength of the Bjorksten finish can b advanced further.

"Universal Type Chemical Finishes fo Glass Fibers Used in Reinforced Plastics." P. Erickson, I. Silver, and H. A. Perry, Jr. Naval Ordnance Laboratory. Order PB 121172 from OTS, U. S. Department o Commerce, Washington 25, D. C. Paper, 17 pages. Price, 50¢.

Five chlorosilane-type finishes for glas fibers were synthesized and evaluated fo resin-glass adhesion. Laminates of 181 glass cloth with NOL 24 finish were bonded with phenolic, epoxy, and polyester resins. They exhibited ultimate flexural strengths, dry, ranging from 97,000-108,000 psi. NOL 24 was then selected for commercial development.

"The Development of Electrical-Conducting Transparent Coatings for Acrylic Plastic Sheets.—Part I." G. A. Dalin and R. W. Freedman, Wright Air Development Center. Order PB 121208 from OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 47 pages. Price, $1.25.

Methods for preparing transparent, conductive films on both acrylic and glass surfaces are evaluated, and structure theories are presented for the coatings. Preparation techniques are described for sputtering of metallic cadmium under oxide-forming conditions, and the preparation of thin, continuous films of silica and titania as undercoatings.

ONE OF A BATTERY OF PRESSES

now being installed at APPLIED PLASTICS

Built and Designed by ERIE ENGINE & MFG. CO.

Here is one of a line of EEMCO Hydraulic Presses especially designed and built by Erie Engine & Mfg. Company to fit the particular needs of the Applied Plastics Company's operation. Due to the many different jobs common to a custom molding shop, they needed presses which were adaptable to various cycles of compression molding and transfer molding. These presses are designed to handle any job and operate automatically.

The set-up man adjusts pressure required, speed of closing, opening speed and the required timing cycle. All the operator does is press a button for start of cycle.

"Production increased . . . fewer rejects" says
LLOYD MOORE
Pres., APPLIED PLASTICS CO.
ERIE, PA.

"We find that our EEMCO presses have increased production and cut down rejects. The human element of error has been practically eliminated through the automatic cycle and pressure controls, which also allow for more constant quality and more productive work schedules. Less skilled operators are now able to turn out a steady flow of first quality work in less time."

Pictured above is one of the EEMCO Presses installed at Applied Plastics. This press has platen area of 36" x 36" and capacity of 314 Tons.

EEMCO can help you, whether you need 1 press or a battery of presses—with or without controls.

In addition to standard size presses, EEMCO designs and builds units to meet your specifications.

PRESSURE CONTROL

Controls fast closing speed—allows complete flexibility of pressure adjustment to suit each job.

CYCLE CONTROL

Controls may be set for automatic operation of the cycle desired—for either compression or transfer molding.

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Write or wire for complete details.

ERIE ENGINE & MFG. CO.

957 EAST 12TH STREET, ERIE, PA.

Designers and builders of a complete line of Mills and Hydraulic Presses for the RUBBER, PLASTICS, FIBERGLASS and WOOD PRODUCTS INDUSTRIES.

Abstracts of Important Articles

Materials

"Polymers and Copolymers of Vinyl Bromide," G. Blauer, *Poliplasti*, 4, 13, 4 (Jan.-Feb. 1956).

Hitherto, polyvinyl bromide has received relatively little attention, chiefly because of its instability and tendency to darken under slight heating. This article shows that moderately stable polymers can be prepared, as well as copolymers of vinyl bromide and methyl methacrylate and of vinyl bromide and styrene which have some interesting properties. (In Italian.)

"Solvents for Vinyl Resins," C. Caldo, *Mat. Plastiche*, 22, 2, 92 (Feb. 1956).

The solubility of several groups of vinyl resins, except PVC, is discussed and tables are provided giving the solubility of individual polymers and copolymers in a number of solvents. (In Italian.)

"Resistance to Surface Arcs," A. Mattea, *Mat. Plastiche*, 22, 2, 131 (Feb. 1956).

An Italian method of determining the resistance of phenolic, urea, and melamine plastics to surface discharges uses two tungsten electrodes four millimeters apart, and weighed down on the sample by a 100 gram weight. Voltage of industrial frequency is applied and at least 50 drops of a 0.1% aqueous solution of ammonium chloride are allowed to fall down from a suitable dropper into the space between the electrodes. The test is considered favorable if at the end there are no traces of permanent surface arcs. (In Italian.)

"X-ray Diffraction as Means of Investigation in Macromolecular Research," G. Lanzavecchia, *Mat. Plastiche*, 22, 3, 171 (March 1956).

The use of X-rays in analyzing and identifying polymers, and for studying their molecular and crystalline structure, physico-chemical properties, and characteristics is reviewed. The structure of polyethylene, polyamides, rubber and gutta percha, and polyethylene terephthalate, in particular, is discussed. (In Italian.)

"Molecular Characterization of PVC," G. Ciampa, *Mat. Plastiche*, 22, 2, 87 (Feb. 1956).

The K-value of Fikentscher, which represents the relative viscosity of a high polymer at a given concentration in a given solvent, and is used to determine molecular weights of high polymers, accurately indicates the molecular weights of different types of PVC. The determination of relative viscosity and the factors affecting the K-value (concentration and temperature) are explained. (In Italian.)

"Weathering of Ethylcellulose Plastic. Extent of Various Types of Degradation," Malcolm Chamberlain, R. A. DeLap, and C. L. Stacy, *Ind. Eng. Chem.*, 48, 7, 1209 (July 1956).

Data are presented to show that a means of excluding sunlight from the plastic mass is of primary importance in stabilizing ethyl cellulose for weathering applications. When light is excluded, antioxidants are needed only to retard the relatively slow thermal oxidation.

"Polysulfide Liquid Polymer and Modified Epoxy Resin Casting Compounds," A. J. Breslau and K. R. Cranker, *SPE J.*, 12, 9, 36 (Sept. 1956).

A discussion of two types of compounds; polysulfide polymer based compounds which cure at room temperature to tough, rubber-like materials, and the polysulfide polymer-modified epoxy resins which cure at room temperature to either flexible or solid plastomers. The properties of these compounds make them outstanding for use as casting resins in potting and encapsulation applications.

"A Method for Evaluating Low Temperature Shock Resistance," L. S. Buchoff, *SPE J.*, 12, 8, 34 (Aug. 1956).

The method uses a mold steel hex bar wrapped with 0.0031-inch diameter wire and potted in the resin to be tested.

In the reference system used, the first number following the magazine name is the volume number, the second is the issue number (if any), and the third is the first page on which the abstracted article appears in that magazine.

Request for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. A complete listing of the publishers and addresses of these magazines is printed here quarterly.

The next complete listing will appear in December.

Equipment

"High Frequency Welders for Thermoplastic Materials," C. Di Piero, *Poliplasti*, 4, 13, 9 (Jan.-Feb., 1956).

Current welding machines and the mechanical and electrical prerequisites for satisfactory welding are discussed. A welding process which employs independent thermal cycles and pressure is described. Finally, various accessory devices are mentioned. (In Italian.)

"Processing Plexigum on Screw Extruders," E. Friedrich, *Plastverarbeiter*, 7, 129 (April 1956).

The functions of the main parts of extruders are described, with emphasis on design of the screw as it affects ultimate results. Special reference is made to the processing of two standard grades of Plexigum. (In German.)

"Steel Rule Dies in the Processing of Plastics," H. Gut, *Plastverarbeiter*, 7, 1, (Jan. 1956).

Blanks of PVC, polyethylene film, vinyl collan foamed plastics, celluloid, etc., for making boxes and simple containers are being cut out with the aid of dies which consist of a support of plywood or Plexiglas, a cutting element of special steel strip and an ejector of sponge rubber. The construction of these dies, the forces involved in cutting with them, and the economics of the method are briefly discussed. (In German.)

"Additional Tests on Plastics with a New Impact Tester," W. Spath, *Gummi u. Asbest.*, 9, 5, 248 (May 1956).

On a variety of plastics, it is demonstrated that the simultaneous measurement of impact (striking) energy and maximum load permits the plotting of diagrams which provide a clear picture of the momentary impact behaviour. (In German.)

Processing

"Precision Finishing by Tumbling," W. E. Brandt, *Modern Plastics*, 34, 1, 15 (Sept. 1956).

Tumbling actions and the potentialities of available equipment and media are discussed, together with relative effectiveness of different methods of deflashing, finishing, and polishing. Typical barrel sizes, loads, speeds, and cycles for plastics parts are given.

"Protective Potting of Glass Vacuum Tubes and Ceramic Capacitors," A. A. Benderly, J. W. Tidler, and B. Greene, *SPE J.*, 12, 8, 30 (Aug. 1956).

Test results indicate that uncoated ceramic capacitors can be potted directly in epoxy resin without fear of cracking or other failure. Glass vacuum tubes should

be potted in epoxy resin without first ing given a resilient coating. Other re- ts are given for polyethylene catacombs h resin-tight tube chambers; epoxy poly- ide-rubber copolymers as potting mate- ls; and wax-isobutylene mixture for ting.

"The Production of Laminated Plastic ubing," W. R. Scherer, *Western Plastics*, 9, 16 (Sept. 1956).

A description of rolled and molded tub- g produced by Taylor Fibre Co.

"Considerations of some Basic Faults in olystyrene Molding," M. Fuzzard, *Brit. lastics*, 29, 5, 176; 29, 6, 217 (May and une 1956).

With the aim of providing wider knowl- dge and aid at the "shop level" in actual olding, the author discusses the main actors responsible for faults in injection olding of polystyrene. These are prima- ily heat and pressure, but also packing, tresses, and lubrication. He suggests some emedies and provides "fault-finding" charts n which faults are listed together with robable causes.

"Decorating or Lettering Molded Plastic Parts," G. Hessel, *Plastverarbeiter*, 7, 3, 84 (March 1956).

Description of the Swiss Ornapress method of decorating molded articles, mainly of urea or melamine resin, which employs a transfer film consisting essentially of a cellulose support carrying color and resin. (In German.)

"Causes and Cures of Defects in Making Screen Printing Stencils," E. Mertes, *Plastverarbeiter*, 7, 3, 98 (March 1956).

A discussion of some defects arising in the direct screen printing process with polyvinyl alcohol, and in the indirect process with a commercial film. (In German.)

"Outline of Vacuum-forming," A. Thiel, *Plastverarbeiter*, 7, 1, 2 (Jan. 1956).

Negative and positive forming, and the heating problems involved, are reviewed. The appropriate materials are briefly mentioned, and costs of vacuum forming and of injection molding are compared. (In German.)

"The Holofol Process and its Applications," W. Opavsky, *Plastverarbeiter*, 7, 4, 141 (April 1956).

This is essentially a summary of various articles which have appeared from time to time in the above periodical on the Holofol process of making seamless goods from a single sheet of rubber or plastic material. (In German.)

"Production of Injection Molded Plastic Parts by Means of Extruders," W. A. H. Eckhardt, *Kunststoff-Rundschau*, 3, 2, 41 (Feb. 1956).

The extrusion molding process is described in detail, and suggestions are offered for appropriate designing of extrusion heads and nozzles, as well as for the processing of raw materials. Examples of the applications of the process are given. (In German.)

"Production of Polyester Pipe, Fittings, Rods and Profiles," H. Hagen, *Kunststoff-Rundschau*, 3, 1, 1; 3, 2, 37 (Jan. and Feb. 1956).

American, British, and German methods and equipment for producing glass fiber-reinforced polyester pipe are described in detail. The advantages and disadvantages of the material for this purpose and the extent to which epoxy resins could replace the polyesters are considered. American standards and testing specifications for polyester pipe are cited. Finally, continuous and discontinuous methods of making rods, including fishing rods, and profiles are discussed. (In German.)

Applications

"Rigid Plastic Containers and Transparent Packages," E. Escales, *Kunststoffe*, 46, 6, 249 (June 1956).

The production of rigid plastic containers and transparent packages, chiefly for foodstuffs and delicacies, is described. The characteristics of the plastics and the properties of the containers and the limits of their usefulness are considered. (In German.)

"Reinforced Plastics in Airplane Construction," R. J. Schliekelmann, *Plastica*, 9, 1, 11 and 9, 2, 70 (Jan. & Feb. 1956).

About 300 kg. of glass-reinforced plastics were used in the construction of the Fokker F-27 plane which made its first flight late in November 1955. The mechanical properties of these materials are compared with Durestos RA 1 (a phenolic-asbestos material) and Durals 75 ST and 24 ST. The methods of production are described, in which templates made from photographic reproductions of drawings were used. Finally, the economics of the use of the reinforced plastics are discussed. (In Dutch.)

"Epoxy-Base Adhesives in the Aircraft Industry," William Bandaruk, *SPE J.*, 12, 8, 20 (Aug. 1956).

Some of the problems involved in aircraft applications of these adhesives are described and test data are given.

"How to Apply and Sinter Fluorocarbon Coatings," Gene Bartczak, *Modern Plastics*, 34, 1, 127 (Sept. 1956).

The application, drying, and sintering of the coatings is discussed in detail, with emphasis on spraying techniques, economics of the various coating techniques, and quality control methods.

"Reinforced Plastics in Airplane Construction," L. Dogliotti, *Poliplasti*, 4, 13, 6 (Jan.-Feb. 1956).

Progress in the employment of reinforced phenolics, melamines, silicones, polyesters, polyamides, ethoxylene, and acrylics in the airplane industry is reviewed. (In Italian.)

"Plastic Piping for Conveying Fresh Water," L. Kreft, *Plastverarbeiter*, 7, 5, 162 (May 1956).

After discussing the properties of rigid PVC and high and low molecular weight polyethylene as they are affected by temperature and other conditions of use, the author considers the advantages and disadvantages of piping for conveying fresh water made from these materials. The problems encountered are discussed, including jointing, price in comparison with steel piping, and installation. In the last connection, it is mentioned that personnel training centers have already been set up in six West German cities. (In German.)

"Tubing of Synthetic High Polymers," A. Melicchia, *Poliplasti*, 3, 12, 3 (Nov.-Dec. 1956).

Synthetic high polymers, including polyethylene, PVC, polystyrene plus rubber, and cellulose acetate butyrate, have special properties which render them suitable for piping and tubing for specific purposes. These qualities are utilized in America and in Western Europe (mainly in England, France, West Germany, and Italy) for conveying water, in heating and refrigeration, and in industrial and chemical plants, as well as in the food industries and for medical and hygienic purposes. There are tables showing physical properties of the various materials, and technological details also are given. Some of the leading producers of appropriate plastics in Europe and America are listed; also the chief Italian manufacturers of plastic tubing and piping. Additional tables list the dimensions and weights of various types of PVC piping made in Italy, America, and Germany. (In Italian.)

General

"Some Aspects of the Toxicology of Plastics," R. Forquet, *Mat. Plastiche*, 22, 2, 100 (Feb. 1956).

The effect on health of contact with plastics is briefly considered, the chief materials being formaldehyde and polyamide resins, polyethylene, polymethacrylate, and PVC. Most plastics are inert, but the addition of compounding ingredients may provoke irritations. The effect of plasticizers and stabilizers in PVC is particularly mentioned, and those that are harmless are listed. (In Italian.)

Patent Digest

Materials

Copolymers of a Perfluorochloroethylene and a Fluoroethylene and Method for Their Preparation. No. 2,752,332. Francis J. Honn, Bloomfield, N. J. (to M. W. Kellogg Co., Jersey City, N. J.).

The copolymer contains about 70-80 mole per cent trifluorochloroethylene and 20-30 mole per cent vinylidene fluoride as the sole monomeric components.

Azeotropic Separation of Vinyltoluene from Ethyltoluene. No. 2,752,295. William F. Yates and Pennell C. Kelly, Texas City, Tex. (to Monsanto Chemical Co., St. Louis, Mo.).

The processes comprises adding diacetone alcohol, and subjecting the mixture to distillation at a pressure below 20 mm. Hg. absolute, and a temperature below 100° C. A polymerization inhibitor is used, and the diacetone alcohol-ethyltoluene azeotrope is removed.

Polymerized Styrene Molding Compositions. No. 2,752,315. N. S. Kuettel, Arlington, N. J. (to Curtiss-Wright Corp., Carlstadt, N. J.).

This injection molding material consists of the following: 100 parts polystyrene resin, 20 parts diatomaceous silica, 6 parts wax, and 0.5 part stearic acid.

Chromosulfonated Hydrocarbon Polymer Compositions Containing Anti-Gelling Agents. No. 2,752,317. Ralph H. Sudekum, Wilmington, Del. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

The fluid composition comprises an uncured halo-sulfonated hydrocarbon polymer in an inert organic solvent, the latter being capable of swelling the polymer. Curing agents, and at least one anti-gelling agent, are added.

Polyester Compositions. No. 2,752,320. Hobson D. DeWitt, Decatur, Ala. (to Chemstrand Corp., Decatur, Ala.)

The composition comprises a homogeneous, miscible mixture of a solvent selected from the class consisting of molten chloral hydrates; a synthetic, linear condensation polyester of a dicarboxylic acid; and a glycol in which the terminal hydroxy groups are separated by 2-10 methylene groups.

Heat-Stabilized Polyvinyl Chloride Composition. No. 2,752,319. Paul H. Lipke, Jr., and Robert S. Montgomery, Midland, Mich. (to Dow Chemical Co., Midland, Mich.).

The compound consists of PVC, an alkylene glycol ester, 0.1-10% by weight of the glycol ester of a triaryl-phophite, and a heat stabilizer of the basic lead silicate type.

Manufacture of Solid Polymerization Catalysts. No. 2,748,090. Charles H. Watkins, Western Springs, Ill. (to Universal Oil Products Co., Des Plaines, Ill.).

A metal salt is admixed with an acidic oxide of phosphorus, transferred to a solid adsorbent, dried and calcined, and treated with a boron halide.

Cellulose Derivative Compositions. No. 2,748,091. Arthur L. Allewelt, West Chester, Pa. (to American Viscose Corp., Philadelphia, Pa.).

The composition comprises a thiourethane of cellulose acetate and a compound selected from the group consisting of polymethylene terephthalates and polymers of mono-ethylenically unsaturated monomers.

Modified Alkyd Resin and Method of Preparing Same. No. 2,748,092. John H. Daniel, Jr., and Ray T. Corkum, Stamford, Conn. (to American Cyanamid Co., New York, N. Y.).

The process involves heating a polycarboxylic acid, a polyhydric alcohol, a drying or semi-drying oil, a monomeric styrene, and a monomeric acrylonitrile in the presence of a peroxide catalyst and a mutually inert solvent. The reaction is stopped when a 60% solids solution has a viscosity of F-Z_5 on the Gardner-Holdt scale.

Production of Polyurethanes Using Tri- or Tetra-Functional Reactants. No. 2,748,102. Guenther Daumiller, Ludwigshafen, Germany (to Badische Anilin- & Soda-Fabrik Aktiengesellschaft, Ludwigshafen, Germany).

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Price, 25c each.

Polyurethanes with improved rigid and dimensional stability are obtained by reacting a diprimary aliphatic diamine with a bis-chlorocarbonic acid ester in the presence of an acid binding agent. A small amount of an aliphatic triamine also is added.

Plasticization of Perhalocarbon Polymers. No. 2,748,098. Herbert J. Passino, Englewood, N. J. (to M. W. Kellogg Co., Jersey City, N. J.).

Monomeric tetrafluoroethylene is polymerized in the presence of polychlorotrifluoroethylene, the latter acting as a plasticizer.

Polyamide Compositions Containing a High Percentage of Metal Filler. No. 2,748,099. Walter M. Bruner and Peter J. Wayne, Wilmington, Del. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

A linear, synthetic polycarbonamide is admixed with a finely-divided metal filler such as copper or lead, the proportion being 1:8-15.

Water-Soluble Phenol-Formaldehyde Condensation Products. No. 2,748,101. Harold M. Shappell, Bound Brook, N. J. (to Union Carbide & Carbon Corp., New York, N. Y.).

This material is an alkaline-catalyzed, water-soluble, heat-hardenable condensate of one mol phenol and 1.1-3 mols formaldehyde, reacted at a pH of 8.4-11.5 and neutralized with boric acid.

Copolymers of Vinyl Esters with N-Allyl Urethanes and Hydrolysis Products Thereof. No. 2,748,103. William J. Priest, Rochester, N. Y. (to Eastman Kodak Co., Rochester, N. Y.).

The material consists of 95-99.9% by weight of vinyl alcohol and 0.1-5% by weight of allylamine.

Process for Chlorinating Ethylene Polymers in Solution. No. 2,748,105. Wilhelm Becker and Otto Bayer, Leverkusen-Bayerwerk, Germany (to Farbenfabriken Bayer Aktiengesellschaft, Leverkusen, Germany).

Highly-chlorinated ethylene polymers of high molecular weight are obtained by reacting them with chloroform and a compound of the group consisting of carbon tetrachloride, trichloroethylene, and chlorobenzene. Solution temperature is maintained at 70-80° C.

Resinous Coating. No. 2,749,322. Kenneth J. Lissant, Kirkwood, Mo. (to Petrolite Corp., Wilmington, Del.).

A mixture of furfural and furfuryl alcohol is diluted with a ketonic solvent and polymerized in the presence of a proton-donor catalyst. A temperature of

-90° C. is maintained until the mixture pproaches incipient gelation. Additional tonic solvent is used to quench the re-tion.

Short Oil-Styrenated Alkyd and Method. o. 2,749,320. Norman Spellberg, Chi-go, Ill. (to Sherwin-Williams Co., Cleve-nd, O.).

The compound is a non-conjugated, non-odied, unoxidized, oil-aromatic, vinyl-odified alkyd with an iodine value of 20-205.

Solutions of Acrylonitrile-Vinyl Chlor-de Copolymer Mixed with Polymers of ultinuclear Aromatic Monomers. No. 749,321. George E. Ham, Dayton, O. o Chemstrand Corp., Decatur, Ala.).

Two to 35 parts by weight of a vinyl ompound are blended with 65-98 parts y weight of a copolymer of vinyl chloride nd acrylonitrile.

Pyrimidine-Aldehyde Resins. No. 2,749,-24. Henry A. Walter, Longmeadow, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

These thermosetting resins comprise the eat reaction products of 1-6 molar por-ions of an aldehyde with one molar por-ion of a pyrimidine.

Catalyst and Process for Making Vinyl Esters. No. 2,750,410. Eugene W. Hanszen and Lawrence B. Trenholme, La Marque, Tex. (to Union Carbide & Carbon Corp., New York, N. Y.).

Vinyl acetate is produced by reacting vapors of acetylene and acetic acid at a temperature of 130-350° C. in the pres-ence of a zinc acetate catalyst supported on activated carbon. Minute amounts of cop-per and bismuth oxyiodide are added.

Polymerization of Acrylonitrile. No. 2,751,374. Arthur Cresswell, Stamford, Conn. (to American Cyanamid Co., New York, N. Y.).

This process involves the addition poly-merization of acrylonitrile in the presence of an oxidation-reduction catalyst system comprising chloric acid and either sulfuric or hydrosulfurous acid.

Polyvinyl Sulfonamides and Process for Preparing the Same. No. 2,750,358. Harold F. Park, East Longmeadow, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

Polyvinyl ammonium sulfonate is pre-pared by reacting PVC and a swelling agent with at least one mol of ammonium sulfite per mol of combined chlorine. The mixture is then dehydrated at a polyvinyl sulfonamide-forming temperature, using a dehydration catalyst.

Phenol-Formaldehyde Polymer of N-p-Toluenesulfonyl-L-Tyrosine. No. 2,750,-347. Joseph F. Bunnett, Chapel Hill, N. C. (to United States of America as repre-sented by the Secretary of the Navy).

The optically-active polymer is formed by refluxing a mixture of the above-named material with phenol, formalin, glacial acetic acid, and sulfuric acid at a tem-perature of 125-138° C. Upon formation of a sticky, white polymer, the heat is lowered somewhat and refluxing is stopped.

Stable Condensates of Urea and Formal-dehyde in the Presence of Methanol. No. 2,750,356. Melvin D. Hurwitz, Huntingdon Valley, Pa. (to Rohm & Haas Co., Phila-delphia, Pa.).

Urea and formaldehyde in a mol ratio of 1:2.5-1:3 are heated to a temperature of 60-80° C. in an aqueous solution having a pH of 7.5-9. This reaction is continued until at least 85% of the formaldehyde appears chemically bound, as determined by alkalinity titration. The mixture is then acidified to a pH of 3-3.8 and heated with methanol under reflux.

Stabilization of Trichloroethylene. No. 2,751,421. William O. Stauffer, Wilming-ton, Del. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

The composition comprises trichloroeth-ylene and a stabilizing amount of a t-butyl-4-hydroxyanisole.

Purification Process for Fluorine-Con-taining Polymers. No. 2,751,376. William S. Barnhart, Cranford, and Russell M. Mantell, Orange, N. J. (to M. W. Kellogg Co., Jersey City, N. J.).

Metallic and oxidizable organic contami-nants are removed from polymers contain-ing carbon and fluorine by washing with a water-soluble carboxylic acid and a water-soluble, inorganic, metallic-oxidizing agent.

Purification Process for Fluorine-Con-taining Polymers. No. 2,751,375. Russell M. Mantell, Orange, and William S. Barn-hart, Cranford, N. J. (to M. W. Kellogg Co., Jersey City, N. J.).

Metallic impurities are removed from tetrafluoroethylene by washing with acetic acid on a 10-150 mesh screen.

Equipment

De-Airing Pebble Extrusion Chamber. No. 2,749,590. Myron O. Kilpatrick, Bartlesville, Okla. (to Phillips Petroleum Co., Bartlesville, Okla.).

The apparatus comprises a hollow cylin-der with a die-shaped, perforated closure member in the forward end; a removable, reciprocable, close-fitting piston with a flat nose; a loose-fitting section forming a narrow space between the nose and the cylinder; and an exhaust line communi-cating from the outside.

Apparatus for Continuous Molding of Synthetic Resins. No. 2,750,625. Roberto Colombo, Turin, Italy (to Royal Mfg. Co., Inc., a corporation of Arizona).

This apparatus for forming hollow, plastic articles has a sectional mold com-prising a pair of complementary mold halves, a means for collapsing and sealing the tubular plastic material as it enters the mold cavity, a jaw-means, a fluid-injector means, and an actuating means.

Apparatus for Working and Advancing a Plastic Material. No. 2,750,627. Alvin N. Gray, Edgewood, N. J. (to Western Elec-tric Co., Inc., New York, N. Y.).

This apparatus comprises a conduit; a rotatably-mounted, elongated stock screw; a hollow perforated shell, connected for rotation with the screw; an extrusion head mounted at the delivery end of the con-duit; and a means for rotating the screw.

Apparatus for Plasticizing and Straining Organic Plastic Compounds. No. 2,750,626. George E. Henning, Baltimore, Md. (to Western Electric Co., Inc., New York, N. Y.).

The apparatus consists of a conduit, a rotatably-mounted stock screw, an extru-sion head, an elongated core tube, an articulated strainer of tubular form, and a means for rotating the stock screw.

Process of Forming Shell Molds. No. 2,749,586. Everard F. Kohl, Lakewood, and Zenon Kazenas, East Cleveland, O. (to Mercast Corp., a corporation of Dela-ware).

Shell molds are prepared by applying a slurry-like investment coating to a frozen mercury pattern. The coating is a refrac-tory material of fine particle size bound with an organic resin. This shell layer is dried at a temperature below the freezing point, and the mercury is lique-fied and removed. The shell mold is then impregnated with a second, inorganic binder which is effective at elevated tem-peratures. Heating causes the organic binder to become porous and provide for the exit of vapors.

Extrusion Apparatus for Sheathing Elec-tric Cables. No. 2,751,077. Aubrey Latin and George Thomas Wilson Grieve, Lon-don, and James Conning, Bexley, England (to Okonite Co., Passaic, N. J.).

The apparatus comprises a die box, a tubular mandrel, a through-bore, a metal-charging chamber of annular shape, a

conical inner die, a masking ring, and an annular flange and hub.

Method and Apparatus for Extrusion of Plastic Materials. No. 2,750,034. Harvey M. Gersman, New York, N. Y.

The tubular extrusion member has a predetermined minimum angle of internal flow and a predetermined angle of rupture. Other features include an inner sidewall, a movable end wall, and a concave feed-surface.

Method of Making Molds for Thermoplastics. No. 2,749,294. Thomas W. Winstead, Baltimore, Md. (to Hedwin Corp., Baltimore, Md.).

Sheet-like thermoplastic replicas of relief surfaces are produced with special molds which are prepared in a flat, flexible design. This design original is formed into a continuous woven tubular web with the relief characters on the inside. The tube is cemented externally to a surrounding support, rendered electrically conductive, immersed in an electrolytic bath, electrodeposited with a hard metal, and vapor blasted.

Perforating Machine for Thermoplastic Films. No. 2,748,863. Harold Z. Benton, Woodstock, Ill.

The apparatus comprises a perforating cylinder with a plurality of closely-spaced tapered pins arranged in annular rows, an anvil roller with annular ridges, a film-guiding means, a means for heating the perforating cylinder, and a means for cooling the anvil roller.

Method and Apparatus for Continuously Forming Elongated Shapes from Thermoplastic Materials. No. 2,747,224. Robert B. Koch and Ralph E. James, Reading, Pa. (to Polymer Corp., Reading, Pa.).

The apparatus comprises a screw-feed device for continuously advancing a stream of softened plastic material under pressure. The device has a variable control mechanism for regulating the screw speed, a hollow forming device through which the plastic passes and takes shape, a pressure-responsive element, and a control connection.

Production of Nylon Rod. No. 2,747,222. Robert B. Koch, Reading, and Ralph E. James, Jr., Lincoln Park, Pa. (to Polymer Corp., Reading, Pa.).

Elongated shapes are formed from synthetic, linear polyamides by directing the molten material into a forming tube. As the material progresses through the tube, heat is lost to the tube wall.

Processing

Method of Making Loom Picker from Polyvinyl Alcohol and Product. No. 2,750,348. John W. Baymiller, Manheim Township, Lancaster County, Pa. (to Armstrong Cork Co., Lancaster, Pa.).

The loom picker is molded from a composition containing polyvinyl alcohol and a metal stearate, which has been heated with mastication in air to a temperature of 280-340° F., prior to molding.

Sizing of Vinylidene Chloride Copolymer Surfaces. No. 2,748,027. John Warren Meier, Madison, Tenn. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

The surface characteristics of regenerated cellulose film can be improved by spraying with a film of vinylidene chloride and at least one ethylenically unsaturated monomer which is polymerizable with vinylidene chloride. The amount of dispersion sprayed on the film should be sufficient to deposit 0.025-0.1 gram of solids per square meter of surface on each side, and particle size should be within the range of 10-50 microns.

Glass Fiber Product and Process. No. 2,748,028. Henry M. Richardson, Springfield, Mass. (to Atlas Powder Co., Wilmington, Del.).

A superficially dry, pliable mat of glass fibers is adhered to a dry, solid, fusible, curable resin composition of a polymerizable polyester and a small amount of vinyl polymerization catalyst. The polyester should be the esterification product of an ethene dicarboxylic acid with a stoichiometric quantity of a polyhydric alcohol, and should have a melting point of at least 80° C.

Method of Making Molded Plastic Washing Machine Agitator. No. 2,748,045. William L. Kelly, Chicago, Ill.

A coated, washing machine agitator of generally circular form is made by molding a plurality of sector-shaped sections and assembling them under heat and pressure. The sections consist of a resinous body material, a fibrous reinforcing material, and a liquid resinous coating.

Method of Shaping Thermoplastic Sheets. No. 2,749,572. Roger L. Nowak, West Boylston, Mass. (to Brode Milling Co., Inc., Clinton, Mass.).

Thermoplastic sheet can be formed into a deep-drawn container with an outwardly-extending, curled, top edge by clamping the sheet across a top cavity which slopes toward and connects with a mold cavity, and has formed therein an annular groo concentric with the mouth of the cav The sheet is then subjected to non-unifo heat to effect differential plasticity, a air is withdrawn to create a vacuum.

Plastic Structural Member. No. 2,74 048. Alfred W. Russell, Farmingda N. Y. (to Russell Reinforced Plastics Cor Lindenhurst, N. Y.).

Plastic structural members are form by superimposing two layers of resin wi a strip of non-adherent material, less wi than the resin layers. The longitudin edges of the resin layers are bonded t gether, with a pocket extending longitud nally between them.

Reinforced Walls of Holes in Plast Members and Method of Making Sam No. 2,748,047. Ralph L. Kuss, Findlay, O

The walls of registering holes in two op posed plastic members are reinforced b interposing a stiff plastic insert having melting temperature below that of th members. Heat and pressure are the applied to their outer edges to effect a integral seal.

Method of Butt Welding Thermoplasti Sheets. No. 2,751,321. Marcel Sans, Lyon Villeurbane, France (to Societe de Con structions Mecaniques de Stains, Paris France).

Sheets of thermoplastic material ar abutted to form a V-shaped, cross-sec tional groove. Unplasticized welding bead and strips of the same material are super imposed in this groove, heated to softenin temperature, and peened.

Process for Manufacturing Ribbed, Ex truded Sheet Material. No. 2,750,631 Samuel J. Johnson, West Chester, O. (to Clopay Corp., Cincinnati, O.).

Molten thermoplastic material is ex truded in a vertical, upward direction in the form of a seamless tube. A plurality of ribs are formed on one surface and, since the tube is inflated and cools as it moves upward, the ribs appear on both surfaces.

Method for Producing Plastic Encased Articles. No. 2,747,230. Finn H. Magnus, Essex Fells, N. J.

A preliminary form is provided, including two sections of cold and hard, fusible, transparent plastic shaped to enclose an article between adjacent sides. The juxtaposed surfaces are cemented together in encircling relation to the article. This preliminary form is then molded and embedded in molten, transparent plastic to a predetermined shape. The preliminary form protects the article against the heat and pressure of the molten material.

...plications

Thermoplastic Design Article. No. 2,-...,640. Elmer P. Scott, New York, N. Y. The article consists of two thermo...stic sheets: one, a base sheet; the ...her, a design sheet which is fused to ...e base sheet along a plurality of dis...nnected lines and at the periphery.

Molded Plastic Spool. No. 2,750,129. ...ouis H. Morin, Bronx, N. Y. (to Coats & ...lark, Inc., New York, N. Y.).

A one-piece, all-plastic thread spool ...mprises an inner tube; an outer, thread-...olding barrel with flanged ends; and a ...air of end walls, which are integrally ...rmed with the tube and barrel. Each ...nd wall comprises the annular end sur...ce of the tube and the barrel. A group ...f radially-arranged, alternate spokes and ...aces extend from the tube to the flanged ...nd of the barrel. A plurality of longitu...finally-spaced supporting ribs extend trans...ersely of the spool from the inner tube ...o the outer barrel. A non-chippable, ...hread-holding nick is cut in the periphery ...f one of the flanged ends.

Hollow Fiber-Reinforced Resin Products Such as Pipe Fittings with Molded Internal Threads and Method of Making Same. No. 2,751,237. Edwin E. Conley, Tulsa, Okla.

The product comprises a hollow body of molded, thermosetting resin with a plurality of laminations of glass fiber fabric. Branches have molded, internal screw-threads, plus a plurality of laminations in the walls. The inner lamination conforms substantially to the contour of the internal threads, and a fibrous strand of high tensile strength extends circumferentially of each branch. The latter aligns with the threads, and engages with the inner lamination.

Laminated Materials. No. 2,748,042. Giusto Borgese, Milan, Italy (to Societa de Linoleum, Societa per Azioni, Milan, Italy).

The facing layer of this laminated floor covering is a polyvinyl resin which is substantially free from fillers, contains 20-30% by weight plasticizer, and is 0.5-1 millimeter thick. This layer is characterized by high resiliency and resistance to wear and scratching. The facing layer is composed of about 90% by weight PVC, and one part by weight of plasticizer for each 10 parts of resin, and is 0.5-0.6 millimeter thick. The laminate reportedly features a reduced tendency to shrinkage and relaxation.

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Current Market Prices

Price Changes and Additions

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Minerals & Chemical Corp.:			
Edgar ASP 200	ton	$43.00	
ASP 400	ton	24.00	
ASP 600	ton	25.00	
ASP 900	ton	19.50	
ASP 1300	ton	80.00	

Plasticizers

Flexol 10-10	lb.	.295 /	.33
10-A, A-26	lb.	.40 /	.435
810	lb.	.29 /	.325
CC-55	lb.	.305 /	.34
DOP	lb.	.285 /	.32
Good-Rite GP-233, -235, -236	lb.	.40 /	.435
GP-261	lb.	.285 /	.32
GP-265	lb.	.29 /	.325
GP-266	lb.	.295 /	.33

Resins & Molding Compounds

Fluorocarbon

Teflon 1	lb.	4.50 /	5.55
5	lb.	4.75 /	5.80
6	lb.	7.45 /	8.00
30 aqueous dispersion	lb.	5.60 /	6.85

Phenolic

G-E molding powders:			
12401	lb.	.31 /	.41
12408, 12486	lb.	.205 /	.215
12410, 12420	lb.	1.50 /	1.60
12432	lb.	.405 /	.505
12433	lb.	.565 /	.665
12435	lb.	.25 /	.35
12439-A, 12466	lb.	.265 /	.365
12444	lb.	.435 /	.535
12463	lb.	.415 /	.515
12467	lb.	.51 /	.61
12487, 12489, 12884, 12887	lb.	.365 /	.465
12491, 12493, 12853, 12900, 12901, 12902, 12920, 12921	lb.	.21 /	.31
12494	lb.	.385 /	.485
12808	lb.	.50 /	.60
12809	lb.	.66 /	.76
12817-A	lb.	.22 /	.32
12824	lb.	.505 /	.605
12841, 12906	lb.	.255 /	.355

Polyamide

Spencer Nylon 400, 401, 402	lb.	1.33 /	1.50
600, 602	lb.	1.48 /	1.65
601	lb.	1.95 /	2.10
603, 604	lb.	1.83 /	2.00

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PLEASE PRINT

Industrial News Briefs (Con't. from p. 754)

Seiberling Rubber Co.'s plastics division is now producing polyethylene for vacuum formed products. The material will be available in extruded rolls and sheets up to 48 by 96 inches, and in gages from 0.02-0.25 inch. Colors will include black, red, blue, green, white, yellow, and orange.

United States Rubber Co.'s textile division, New York, N. Y., has licensed Collins & Aikman to produce three-dimensional fabrics within U. S. Rubber's patents and patent applications. The material under consideration is Trilok, which incorporates contractible polyethylene strands.

Eastman Chemical Products, Inc., Kingsport, Tenn., has announced the establishment of a sales office for Tenite plastics in Kansas City, Mo. The location is 3435 Broadway Blvd., and the sales representative is William P. Gideon, who formerly worked out of the Chicago office.

Columbian Carbon Co., New York, N. Y., has announced the availability of a 16-mm. color film entitled "Readin'—'Ritin'—Ridin' with Carbon," which describes modern production and industrial uses of carbon black. Screen time is approximately 31 minutes.

Directory

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Domestic Production and Sales of Plastics and Resin Material, June and July, 1956

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of June and July, 1956. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

Over-all declines are still to be noted in all the major categories, especially cellulosics and phenolics. Polyethylene production remained about the same.

	June		July	
	Production	Sales	Production	Sales
Cellulose Plastics:[1]				
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	1,972,943	2,027,736	1,111,937	1,331,082
Sheets, 0.003 gage and over	1,412,532	1,319,926	817,205	1,177,935
All other sheets, rods, and tubes	669,528	640,970	425,686	510,123
Molding and extrusion materials	7,253,919	7,245,497	5,872,025	5,769,005
Nitrocellulose sheets, rods, and tubes	486,846	390,610	344,008	322,601
Other cellulose plastics	407,017	388,882	369,784	261,947
TOTAL	12,202,785	12,013,621	8,940,545	9,372,693
Phenolic and Other Tar-Acid Resins:				
Molding materials[1]	18,990,775	17,830,081	13,454,700	13,020,293
Bonding and adhesive resins for—				
Laminating (except plywood)	5,106,091	3,463,034	3,929,177	2,618,835
Coated and bonded abrasives	1,186,380	1,512,018	1,030,530	1,240,514
Friction materials (brake linings, clutch facings, and similar materials)	1,360,670	1,169,838	r	r
Thermal insulation (fiber glass, rock wool)	4,944,647	3,916,342	4,436,354	4,775,895
Plywood	3,599,542	3,174,595	2,639,811	2,057,243
All other bonding and adhesive uses	2,839,129	2,586,547	3,414,006	3,474,753
Protective-coating resins, unmodified and modified except by rosin	2,292,968	2,536,356	1,793,090	1,881,617
Resins for all other uses	2,579,804	2,179,868	2,302,347	2,104,666
TOTAL	42,900,006	38,368,679	33,000,015	31,173,816
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	2,716,690	2,518,693	2,386,109	2,976,723
Paper-treating and paper-coating resins	2,173,033	1,737,580	1,411,210	1,450,825
Bonding and adhesive resins for—				
Plywood	10,270,436	8,776,182	6,633,016	6,632,443
All other bonding and adhesive uses, including laminating	2,195,589	1,779,264	1,314,221	1,475,584
Protective-coating resins, straight and modified	2,534,879	1,655,235	2,195,973	2,019,916
Resins for all other uses, including molding	7,727,059	6,023,946	4,156,765	5,993,448
TOTAL	27,617,686	22,490,900	18,097,294	20,548,939
Styrene Resins:				
Molding materials[1]	36,090,195	26,966,709	34,154,183	27,254,254
Protective-coating resins, straight and modified	7,895,160	6,797,024	5,977,757	6,462,764
Resins for all other uses	7,932,804	7,298,316	7,123,267	7,118,459
TOTAL	51,918,159	41,062,051	47,255,207	40,835,477
Vinyl and Vinyl Chloride Resins:[3]				
Polyvinyl chloride and copolymer resins (50% or more PVC) for—				
Film (resin content)		5,344,569		4,722,110
Sheeting (resin content)		4,217,449		3,713,711
Molding and extrusion (resin content)		14,945,741		15,202,667
Textile and paper treating and coating (resin content)[1]		4,726,952		4,297,507
Flooring (resin content)		5,315,741		4,230,638
Protective coatings (resin content)		2,363,637		2,680,701
All other uses (resin content)		5,227,774		2,321,487
All other vinyl resins for—				
Adhesives (resin content)		2,863,256		3,164,936
All other uses (resin content)		7,730,785		8,145,830
TOTAL	54,795,808	52,695,605	49,750,804	48,479,587
Coumarone-Indene and Petroleum Polymer Resins	19,465,159	19,031,281	19,241,429	19,066,470
Polyester Resins	6,212,156	5,616,656	5,640,703	5,464,201
Polyethylene Resins	45,633,928	44,137,147	45,998,123	38,826,139
Miscellaneous Synthetic Plastics and Resin Materials:				
Molding materials[1,4]	3,511,591	2,795,909	2,840,927	2,586,244
Protective-coating resins[5]	980,511	452,960	844,338	438,972
Resins for all other uses[6]	9,658,784	8,675,539	8,898,594	7,972,666
TOTAL	14,150,886	11,924,408	12,583,859	10,997,882
GRAND TOTALS	274,896,573	247,340,348	240,507,979	224,765,204

[1]Includes fillers, plasticizers, and extenders.
[2]Production statistics by uses are not representative, as end use may not be known at time of manufacture.
[3]Includes data for spreader and calendering-type resins.
[4]Includes data for acrylic, nylon, silicone, and other molding materials.
[5]Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins.
[6]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.
[7]Included with "All other bonding and adhesive uses."
SOURCE: United States Tariff Commission, Chemical Division.

CALENDAR of COMING EVENTS

November 21
SPE New York Section, Gotham Hotel, New York City.

November 26-30
National Exposition of Power & Mechanical Engineering, Coliseum, New York City.

November 27
SPE Philadelphia Section, Franklin Institute, Philadelphia, Pa.

November 27-30
National Chemical Exposition. Public Auditorium, Cleveland, O.

November 29
ASME Rubber & Plastcs Division. One-day Technical Meeting. Hotel Statler, New York City.
Reinforced Plastic Group, SPE New York Section. Tufaro's Restaurant, Corona (Queens), N. Y.

December 4-5
SPI Film, Sheeting, and Coated Fabrics Division Conference. Commodore Hotel, New York City.

December 5
SPE Western New England Section. Bradley Field, Windsor Locks, Conn.

December 5-6
Plastics Study Group, Building Research Institute. Mutual Insurance Building, Chicago, Ill.

December 6
SPE Southern California Section. Scully's Restaurant, Los Angles, Calif.

December 8
SPE Chicago Section—SPI Midwest Chapter Xmas Party. Edgewater Beach Hotel, Chicago, Ill.

December 10
SPE Cleveland-Akron Section. Spanish Tavern, Brecksville, O.

December 12
SPE Newark Section. Military Park Hotel, Newark, N. J.

December 19
SPE New York Section. Gotham Hotel, New York, N. Y.

January 16-18
SPE Thirteenth Annual Technical Conference. Hotel Sheraton-Jefferson, St. Louis, Mo.

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